PB 131891—T11

CENTRAL INTELLIGENCE AGENCY

(1)

SCIENTIFIC INFORMATION REPORT

5 December 1958

Distributed Only By
U.S. DEPARTMENT OF COMMERCE
OFFICE OF TECHNICAL SERVICES
WASHINGTON 25, D.C.

Issued Semi-monthly. Price: Per year $28.00; Single issue $2.75.

Use of funds for printing this publication approved
by the Director of the Bureau of the Budget July 31, 1958.

Approved For Release 1999/09/08 : CIA-RDP82-00141R000100200001-1

PLEASE NOTE

This report presents unevaluated information extracted from recently received publications of the USSR, Eastern Europe, and China. The information selected is intended to indicate current scientific developments and activities in the USSR, in the Sino-Soviet Orbit countries, and in Yugoslavia, and is disseminated as an aid to United States Government research.

SCIENTIFIC INFORMATION REPORT

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I. BIOLOGY

1. Cereal Rusts in the USSR

"Sporophyte Flora of the USSR. Vol 4, Fungi. I. Rust Fungi. No I. Family Melampsoraceae," by V. F. Kuprevich and V. G. Transhel', Moscow-Leningrad, AN SSSR 1957, 420 p, ill., 29 r. 65 k. (from Referativnyy Zhurnal -- Biologiya, No 9, 10 May 58, Abstract No 38720, by L. N. Kats)

"This detailed monographic description of rust fungi includes a general part (the description concerns rusts in general) and a systematic part (family Melampsoraceae). The history of the study of rusts in the USSR (in floristic, phytopathological, and cytological respects) and their interrelationship with the plants on which they feed, the type of sporogenesis and developmental cycle (a diagram of types of development is presented), and classification and nomenclature are examined in detail. These data are a key for determining the families, tribes, and phyla (19 phyla of the Melampsoraceae family in all). The phylogenetic relationships of rust fungi, their hosts, and their geographic distribution are discussed. Comparative tables of the number of species and phyla of rusts and the number of species according to families of host plants in the USSR, the US, and Canada are presented. Special attention is devoted to parasitism on crop plants. Methodology of work with artificial infection and collection in nature is given. A general bibliography (with brief annotations) of works of Russian authors and some foreign authors which deal with species in the USSR and adjacent countries is included. Lists of accepted abbreviations of authors' names and names of regions of flora of the USSR referred to in the monograph are given. The systematic section contains detailed monographic descriptions of 180 species of Melampsoraceae fungi and diagrams of sporogenesis in many species. There are 160 illustrations. The book is a basic handbook for identifying rusts and for developing measures for controlling them. The herbariums maintained in the Botanical Institute, Academy of Sciences USSR, and in the All-Union Institute of Plant Protection in Leningrad were used in writing the monograph."

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2. Rust Fungi in Kazakhstan

"Sporophyte Flora in Kazakhstan. Vol I. Rust Fungi," by G. S. Nevodovskiy, Alma-Ata, AN KazSSR, 432 p, ill., 24 r, 15 k. (from Referativnyy Zhurnal -- Biologiya, No 9, 10 May 58, Abstract No 38721, by L. N. Kats)

"A detailed monographic description of the rust fungi of Kazakhstan. Detailed descriptions of 351 'rzhavchinniki' [rusts] (257 of them original species) are presented. An explanation of the name 'rzhavchinniki,' basic literature, diagnostic signs, general characteristics of the order, and a description of the different types of development are given in the introduction; the interrelationship between fungi and the plants on which they feed and the extent of their harmfulness, and also control measures, general and for separate basic crops, are examined. This is a key for determining the families and phyla of rust fungi. A description of the different species is given according to the family of the plant on which the fungus feeds. The book is intended for a wide circle of scientific workers, student biologists, and agricultural workers not only in Kazakhstan but also in adjoining oblasts. No bibliography is given."

3. Radioactive Isotope Effect on Chlorophyll Content of Plants

"The Effect of Radioactive Isotopes of S^{35} and P^{32} on Chlorophyll Content of Plants," By N. I. Bidzilya; Kiev, Dopovidi Ukrains'koy Akademii Sil's'kogospodars'kikh Nauk, Vol 3, May/Jun 58, pp 7-10 (Ukrainian, summary in Russian)

"It was shown that treating oat seeds with small doses of P^{32} (100 microcuries per kg of seeds before sowing increases the chlorophyll content of the seedlings. The presowing treatment of sugar-beet seeds with S^{35} did not significantly increase the total chlorophyll content of plant leaves."

4. Diploids Proved More sensitive Than Auto-Tetraploids to Gamma-Radiation

"The Sensitivity of Diploid and Auto-Tetraploid Plants to Gamma-Radiation," by V. V. Mansurova, V. V. Sakharov, and V. V. Khvostova; Moscow, Botanicheskiy Zhurnal, Vol 43, No 7-12, Jul 58, pp 987-997

The aim of this research was to make a comparative study of the sensitivity of diploid and autotetraploid plants toward various types of ionizing radiations. The source of radiation was the radioactive isotope cobalt-60, and the dose was 580-600 r/min gamma rays. The following English abstract accompanies the article.

"The effects of gamma radiation on diploid and auto-tetraploid forms of Polygonum and Panicum have been studied [diploids have 16 chromosomes]. The source of radiation was Co^{60}, and the dosages used were 10, 15, 20, and 30 kr. It has been established that gamma rays reduce the percent germination of seeds and retard the growth of plants. Diploids have proved to be more sensitive to the action of gamma rays. The appearance of mosaic leaves caused by the necrosis of cells has been observed in diploid plants. From the data obtained it is obvious that the nucleus injuries are of decisive importance in the deleterious effect of gamma radiation and that the duplication of chromosome sets in auto-polyploids increases the resistance of plants to the action of gamma radiation."

5. Cobalt Distribution in Growing Plants

"Cobalt Distribution in Plants," by A. F. Agafonova, Mikroelementy v. S. Kh. i Meditsine (Trace Elements in Agriculture and Medicine), Riga, Academy of Sciences Latvian SSR, 1956, 213-219; (from Referativnyy Zhurnal -- Biologiya, No 8, 25 Apr 58, submitted for publication on 22 Aug 58, p 124, Abstract No 31274, by A. P. Shcherbakof)

"Using various methods of chemical analysis, radioautography, and measurement of gamma-radiation activity, studies were conducted on the distribution of cobalt in various organs and tissues of turnips, mustard, beans, and table beets seedlings 6-30 days after being grown on lime-enriched and untreated soils enriched with small quantities of radioactive and nonradioactive cobalt. In turnips and mustard, cobalt was concentrated essentially in the upper leaves and more in their periphery than in the central parts. Significant amounts of cobalt were detected in the root systems. The addition of lime greatly decreased the cobalt

content in the plants. The cobalt content in the parenchyma of beans was less than in their conducting system. During the initial phase of plant growth, cobalt inflow into the upper leaves was greater than into the lower leaves or into other organs. During later phases of growth, cobalt accumulated in the leaves of lower layers. The latter phenomenon is explained by the sluggish movement of cobalt in plants. This work was done at VIUAA [All-Union Scientific Research Institute of Fertilizers, Agricultural Engineering, and Soil Science imeni K. K. Gedroyets]."

II. CHEMISTRY

Chemistry and Technology of Nuclear Fuels and Reactor Construction Materials

6. Intermetallic Compounds and Alloys of Plutonium

"Interactions of Plutonium With Other Metals as Related to Their Position in the Periodic System," by A. A. Bochvar, S. T. Konobeyevskiy, V. I. Kutaytsev, T. S. Men'shikova, and N. T. Chebotarev; Moscow, Atomnaya Energiya, Vol 5, No 3, Sep 58, pp 303-309

The interactions of plutonium with metals of the I, II, III, IV groups, metals of transition groups, and actinides (thorium and uranium) are discussed on the basis of data obtained by the authors of the article and their collaborators. The behavior of plutonium toward metals of the I group is illustrated by the constitutional diagram of the system plutonium-copper, that toward metals of the II group by the diagram of the system plutonium-beryllium, that toward metals of the III group by the diagram of the system plutonium-aluminum, that toward metals of the IV group by the diagrams of the systems plutonium-lead and plutonium-bismuth, and that toward metals of transitional groups by the constitutional diagrams of the systems plutonium-zirconium, plutonium-chromium, plutonium-iron, plutonium-molybdenum, and plutonium-osmium. In the section on alloys of plutonium with actinides, the diagrams of the systems plutonium-thorium and plutonium-uranium are discussed in detail. General relationships pertaining to interactions into which plutonium enters are derived.

7. The Preparation of Plutonium Tribromide

"The Preparation of Plutonium Tribromide and Some Properties of This Compound," by V. V. Fomin, V. Ye. Reznikova, and L. L. Zaytseva; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 10, Oct 58, pp 2231-2235

It was found that notwithstanding the thermodynamic advantages of the reaction $Pu\,O_2 + CO + Br_2$ as compared with the reaction $Pu\,O_2 + HBr$, this reaction is not of great advantage from the practical standpoint, because it takes place only at high temperatures. A convenient laboratory method for the preparation of $Pu\,Br_3$ is by reacting the oxalate of tetravalent plutonium with hydrogen bromide at 500°:

The spectrum of anhydrous plutonium tribromide differs from that of the trichloride, indicating that there is a difference in the nature of the bond.

The density of the plutonium tetrabromide depends on the composition of the compound that has been treated with HBr. This density exhibits a minimum of 5.0 grams per cubic centimeter in the case of the bromination of $Pu_2 (C_2O_4)_3 \cdot 9 H_2O$ and a maximum of 5.8 grams per cubic centimeter in the case of the bromination of PuO_2. The density of the bromide prepared from $Pu (C_2O_4)_2 \cdot 6H_2O$ has an intermediate value.

It has been established that in a stream of bromine vapor, the tribromide evaporates considerably more easily than in the absence of bromine. This is due to the formation of $Pu Br_4$, which is stable only in the vapor state.

The hydroscopicity of plutonium tribromide has been investigated and also the possibility of isolating plutonium tribromide from its solutions in hydrobromic acid. It was established that two hydrates of this salt exist. The absorption spectra of these hydrates were determined.

It was established that both plutonium tribromide and its hydrates decompose under the action of the alpha radiation emitted by plutonium. The yield of this reaction has been estimated.

8. A. A. Grinberg's Work on Complex Compounds, Nuclear Fuels, and Reactor Construction Materials

"Election of Academicians and Corresponding Members of the Academy of Sciences USSR" (unsigned article); Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Khimicheskikh Nauk No 9, Sep 58, pp 1135-1150

A. A. Grinberg is one of the most prominent USSR inorganic chemists. He is known for his work in the field of the chemistry of complex compounds. The major part of research done by Grinberg dealt with physicochemical aspects of the coordination theory, the stereochemistry of platinum metals, redox transformations and acid-base equilibriums in solutions of complex compounds, and processes applied in chemical technology. Grinberg proposed a new method for the determination of the structure of geometric isomers (the so-called Grinberg method), substantiated the coordination formulas of complex compounds of divalent platinum, and was instrumental in the development of the stereochemistry of palladium. He also developed a number of new volumetric methods for

the determination of platinum and iridium and on the basis of extensive research arrived at interesting conclusions pertaining to the mechanism of phenomena responsible for the oxidation potentials of complex compounds of platinum metals.

Grinberg extended the application of Kossel's theory of acids and bases to complex ammonates and checked experimentally N. Bjerrhum's theory of amino acids. Investigations of the magnetic susceptibility of platinum and palladium enabled Grinberg to clarify the nature of the bonds in complex compounds of these metals. A number of experimental and theoretical investigations by Grinberg dealt with relationships pertaining to the trans-effect discovered by I. I. Chernyayev.

Grinberg was the first to propose an explanation of this phenomenon based on polarization.

Experimental data obtained during recent years enabled Grinberg to discover the cis-effect. In addition to the complex compounds of platinum, Grinberg investigated extensively compounds of uranium, thorium, zirconium, and other rare elements of importance in connection with the chemistry of nuclear fuels. One must particularly point out the systematic investigations carried out by him on complex compounds of uranium.

Grinberg was a pioneer in the application of tracer atoms to the investigation of equilibriums and of the mobility of atoms in complex compounds. He applied quite recently the method of isotope exchange in combination with other methods for the solution of problems pertaining to the mechanism of reactions which complex compounds undergo in solutions. In addition to major theoretical investigations, Grinberg did work which resulted in the solution of a number of important problems in the field of chemical technology. Grinberg published about 130 scientific works, including the monograph Vvedeniye v Khimiyu Kompleksnykh Soyedineniy (Introduction into the Chemistry of Complex Compounds), for which he was awarded a Stalin Prize in 1946. At a general meeting of the Academy of Sciences USSR held on 20 June 1958, A. A. Grinberg was elected Academician in the Department of Chemical Sciences within the specialized branch of inorganic chemistry.

9. Extraction of Rare Metals by the Amalgam Method

"At Enterprises and Institutes: (unsigned article): Moscow, Promyshlenno-Ekonomicheskaya Gazeta, Vol 3, No 81 (381), 9 Jul 58, p 1

Rare metals of high purity (containing impurities in quantities of the order of thousandths of 1%), which have acquired a great importance in present-day technology, can be extracted by the so-called amalgam method that has been developed by scientists at the Kazakh University and the Institute of Chemical Sciences, Academy of Sciences Kazakh SSR. Several kilograms of thallium and the first batch of cadmium of high purity have already been produced under industrial conditions. Work is being continued on the application of the new method to the production of indium. In the opinion of Prof M. Kozlovskiy, who is directing this work, the new method will find extensive application in the technology of the extraction of rare metals from the complex multimetal ores that occur in large quantities in Kazakhstan.

10. Treatment of Water for the Generation of Steam at Nuclear Power Plants

"Problems Connected With the Use of Water at Electric Power Plants (Conferences at the Power Engineering Institute)," by T. V. Chernova; Moscow, Vestnik Akademii Nauk SSSR, Vol 28, No 9, Sep 58, pp 117-119

A scientific-technical conference on problems pertaining to the water regime, treatment of water, and measures to be taken for assuring the purity of steam at nuclear electric power stations was conducted 26-28 May 1958 by the Commission on High-Parameter Steam at the Power Engineering Institute imeni G. M. Krzhizhanovskiy. The purpose of the conference was to collate results obtained in work done by Soviet scientists on the water problem at nuclear electric power stations and to draw up plans for further scientific research on different aspects of this problem. Representatives of academic and specialized branch institutes, higher educational institutions, and other interested organizations took part in the conference. The reports presented and their discussion indicated that the complex of problems pertaining to the thermochemical transformations of water in the flow sheet of electric power plants operating on organic fuel has been investigated to a sufficient extent by Soviet specialists in power engineering. However, the research that has been done on the designing of reactors and steam generators was concentrated primarily on physical processes and heat exchange. As far as technology of water treatment and development of

methods for the generation of pure steam at nuclear electric power stations are concerned, not enough work on these subjects has been done hitherto. Problems in this field are of decisive importance from the standpoint of the reliability of the operation of many types of nuclear electric power stations, their assembly, and the indices which determine the economic aspects of the operation.

A number of problems was brought up the solution of which is essential for the development of nuclear power engineering. Furthermore, the work to be done was outlined in connection with this. This work will include research on thermophysical and physicochemical processes ocurring at nuclear electric power plants.

Particular attention must be paid to research assuring the reliable operation of nuclear electric power plants and the design of single-stage flow sheets. This applies to the investigation of the mechanism of entrainment of water with the steam and methods of separating this water from the steam; processes involving the bubbling of steam through water and suspensions following surface evaporation; solubility in the steam of substances the occurrence of which is characteristic for conditions encountered during the operation of nuclear electric power stations and the multistep washing of steam; processes of the formation of deposits, the transfer of radioactive substances, and corrosion in the stages or circuits; and characteristics pertaining to the use of water and methods of removing radioactive substances from it in the closed circuit where it is used.

One must also study methods for the treatment of feed water used for replenishing and compiling instructions on the removal of inorganic and organic hydrosols and colloids from desalinated water, do work on the synthesis and investigation of ion-exchange resins used for ordinary treatment and in electrodialysis processes, and expedite the introduction of these resins into industrial application.

One must further assure the carrying out of investigations relative to the design of condensers operating without vacuum and the development of new designs for equipment of this type and also conduct investigations and compile instructions on the tightening of the shaft, the turbine, the coupling rods for the control of the valves of the turbine, and the shafts of the pumps. Experience acquired in the chemical industry must be taken into this work.

Among problems of primary importance, one must also mention those relative to the nature of the iron and copper compounds present in the water and steam, improvement of the efficiency of methods for the removal

of dissolved gases from the vicinity of nuclear power stations, conditions pertaining to the formation of radioactive deposits in the section of the turbine between inlet and outlet valve through which steam passes and methods for washing out these deposits, removal of moisture from the stages of the turbine and separation of moisture in these stages as well as in intermediate separators for the elimination of water, and conditions pertaining to radioalysis and removal of products formed as a result of it from the closed stages or circuits.

A significant part of the research proposed will deal with the following problems: development of efficient procedures for evaporation in stages within the steam-generating assembly and evaporation in stages in steam generators, development of instructions on anticorrosion measures to be applied before the start of operations, measures for the elimination of oxygen from the water by chemical methods, and determination of the rate of corrosion of materials in the liquid and vapor phases under conditions encountered when these materials are exposed to radiation.

It will be necessary to carry out a number of investigations on the application of synthetic materials and parts made of these materials at nuclear power generating plants with the purpose of replacing the construction materials customarily used at present.

As a result of all of these investigations, experimental data will be accumulated and collated, the physical and chemical aspects of the processes will be studied, and methods will be developed for the calculation and design of the principal and auxiliary equipment of nuclear electric power plants.

To assure successful execution of the work that has been recommended, the conference proposed that particular attention be paid to the expansion of radiometric laboratories and improvement of coordination in work of this type.

In the resolution passed by the conference, it was pointed out that the methods used in a number of investigations are not well-devised, that some of the control and indicating instruments are not sufficiently precise, and that the available methods for the determination of small quantities of impurities are not sufficiently sensitive.

In connection with this, it has been decided to hold a special session on problems involved in methods of measurement and pertaining to the control and indicating instruments used in thermotechnical and physicochemical investigations of processes of water treatment, the contamination of steam, and corrosion as related to conditions encountered in nuclear power engineering.

In view of the fact that a number of accepted calculation standards regulating the content of suspended and dissolved elements in steam does not correspond to the requirements put by rapidly developing applications in the field of nuclear power engineering (e.g., standards relative to the content of chlorides in water used to blow out steam generators and the content of sodium in the steam), the conference recommended that tentative calculation standards be compiled for evaluating the quality of the water and steam in such a manner that the results will be applicable from the standpoint of the more stringent requirements for the purity of steam imposed by the operation of nuclear electric power stations.

A conference on problems of water treatment at thermal electric power plants which employ steam of high, intermediate, superhigh, and supercritical pressures was held 24-27 June 1958. This conference had been organized by the Commission on High-Parameter Steam jointly with the Ministry of Electric Power Stations USSR and the Moscow Department of the Scientific-Technical Society of the Power Industry. The papers presented at this meeting dealt principally with the desalination of water by chemical methods. Particular attention was paid in the papers presented to the magnesia method of removing silicic acid. It was brought out that chemical desalination by means of USSR ion-exchange resins solved the problem of feeding high-pressure (up to 180 atmospheres) drum boilers and opened up wide prospects for the application of highly desalinated natural water and condensed water for the feeding of powerful uniflow boilers operating at supercritical pressures. The results of industrial testing of chemical desalination installations and the prospects of their application at thermal electric power stations operating at superhigh and supercritical steam pressures were discussed in a report given by F. G. Prokhorov.

On the basis of results which are now available, planning and design organizations have begun large-scale work on the designing of ion-exchange desalting installations for thermal electric power plants.

Industrial Chemistry

11. Current Tasks and USSR Chemical Science

"Urgent Tasks of Chemical Science" (unsigned article); Moscow, Promyshlenno-Ekonomicheskaya Gazeta, Vol 3, No 115 (415), 26 Sep 58, p 1

The current emphasis on the expansion of the production of plastics imposes new tasks on chemical research and involves a considerable amount of developmental work in the sense that new and more perfect technological processes must be created.

The principal initial raw materials for the most important branches of the chemical industry are natural gas and by-product gases [of petroleum production] as well as gases of petroleum conversion plants. The treatment of raw material of this type will form the basis for an expansion of the production of polymers including plastics, synthetic fibers, and elastomers. The scientific research institutes will have to develop economically advantageous methods for the production of acetylene by oxidative pyrolysis, electric cracking, and high-temperature pyrolysis of hydrocarbon gases. Extensive work has been planned on problems pertaining to the production of polyethylene at low, medium, and high pressures using different catalysts. Much remains to be done in connection with the development of industrial methods for the production of polypropylene, copolymers of ethylene with propylene, and the conversion of polyethylene, polypropylene, and ethylene-propylene copolymers into articles and films which have advantageous characteristics from the standpoint of applications as electrical insulators and dielectrics.

It will be necessary to develop technological procedures for the production of many new materials including rapidly setting phenol-formaldehyde resins, ion-exchange resins, and polyvinyl chloride compositions. Materials of this type will be applied in the medical and foodstuffs industry. Polymers are needed for pressure molding, the production of insulation for cables, and the manufacture of special heat-resistant adhesives based on organosilicon derivatives and other organo-elemental compounds.

In the field of synthetic fibers, it is of importance to develop methods for the production of very strong viscose cords for tires, of lavsan [dacron] fibers and of nitron [orlon], polyethylene, and other fibers. In connection with the production of polyamide fibers, one must develop methods for the production of adipic acid starting with benzene, butadiene, or furfural, and of hexamethylenediamine, caprolactam derived from benzene and aniline, and aminoenanthic acid synthesized from ethylene and carbon tetrachloride.

The principal task of scientific research and experimental work on lacquers, varnishes, and paints will be replacement of raw material that can be used as foodstuffs and the development of coatings stable at high temperatures.

The principal technical problem in the field of synthetic rubber is replacement of ethyl alcohol derived from foodstuffs, organization of extensive industrial production of butadiene from butane, production of isoprene rubber that is close in its characteristics to natural rubber, and extension of the range of elastomers for general and specific applications. The scientific research institutes will have to do research on polymers with the view of formulating a general theory of structure and developing principles and methods for the production of plastics, elastomers, and other polymers with predetermined structure and properties.

Extensive work will have to be done on the development of the production of new polymers, new technological procedures, and new equipment for the production of these polymers. During the following 2-3 years, the specialized branch institutes ought to develop technological methods and give to the planning organizations engaged in designing data based on the latest achievements of USSR and foreign science and technology, so that a great number of plants, plant departments, and types of production can be planned and designed.

12. A Discussion of Current and Proposed USSR Research on High-Molecular Compounds

"Progress of Research on High-Molecular Compounds (at the Presidium of the Council on the Coordination of Scientific Activities of Academies of Sciences of Union Republics and Affiliates of the Academy of Sciences USSR)" by N. N. Golovkin and O. S. Ignat'yev; Moscow, Vestnik Akademii Nauk SSSR, Vol 28, No 9, Sep 58, pp 101-105

A regular meeting of the Presidium of the Council on the Coordination of Scientific Activities of Academies of Sciences of Union Republics and Affiliates of the Academy of Sciences USSR, which was held on 21 June 1958, dealt with problems pertaining to research in connection with the production and application of high-molecular compounds.

The significance of this research in the light of decisions made by the May 1958 Plenary Session of the Central Committee of the CPSU was pointed out by A. V. Topchiyev, vice-president of the Academy of Sciences USSR. He informed participants in the meeting of the state of research in the field of high-molecular compounds at present, stating that at the Academy of Sciences Ukrainian SSR research is being done on the synthesis

of new linear polymers, ion-exchange resins, and homogeneous membranes consisting of ion-exchange resins. Furthermore, processes of the separation of hydrocarbon gases of the petroleum and gas industries and ways of producing from natural gas chlorinated products forming crude materials for the production of synthetic fibers and plastics are being studied there. Research done at the Academy of Sciences Azerbaydzhan SSR is concerned primarily with the solution of theoretical and practical problems pertaining to an expansion of the supply of raw materials consisting of olefinic and aromatic compounds and the development of processes for the synthesis of monomers and high-molecular compounds.

The Academy of Sciences Armenian SSR is engaged in work on organic synthesis, specifically the synthesis of acetylene derivatives. The Academy of Sciences Uzbek SSR is doing work on the biosynthesis of cotton cellulose and modifications of cotton cellulose with the aim of producing new polymers. At the Ural Affiliate of the Academy of Sciences USSR relationships are being studied which govern the copolymerization of polyfunctional compounds with vinyl monomers.

Topchiyev pointed out that the research being conducted at present is insufficient in scope. He stated that the Academy of Sciences USSR has been charged with drawing up, together with the academies of sciences of union republics, the Ministry of Higher Education USSR, and the State Committee on Chemistry, a tentative (perspektivnyy) plan for research on high-molecular compounds to be done in 1959-1965. A special commission for this purpose has been appointed.

Forty-two principal directions of scientific research have been defined on which efforts should be concentrated.

Successful development of the polymer industry will depend to a considerable extent on the availability of initial materials, i. e., monomers. To assure the necessary supply of monomers, it is necessary to expand theoretical research and to develop new technological processes. Petrochemistry will play a leading role in this development. The principal institutions that are called on to do work in this field will be the institutes of the Academy of Sciences USSR and the academies of sciences of the Azerbaydzhan, Ukrainian, Kazakh, Turkmen, Uzbek, Belorussian, Armenian, and Kirgiz Soviet Socialist Republics and also the Kazan' and Bashkir affiliates of the Academy of Sciences USSR. The principal lines of research to be pursued will comprise problems pertaining to the synthesis of oxygen-containing monomers and monomers containing organoelemental bonds, including organosilicon monomers. A large part of this research will have to be done by the Kazan' Affiliate. At this affiliate research will be done on the synthesis of organophosphorus compounds containing tin, silicon, and other elements and double bonds,

epoxy rings, and other groupings capable of further transformations. A number of scientific institutions within the Academy of Sciences USSR and the academies of sciences of the Azerbaydzhan, Latvian, Kirgiz, and Belorussian Soviet Socialist Republics and the Ural Affiliate of the Academy of Sciences USSR will participate in work on the synthesis of organoelemental monomers and polymers. A number of major lines of research to be conducted will be concerned with the synthesis, application, and conversion of polymers. This research, to give a few examples, comprises the synthesis of new polymers exhibiting a high heat resistance, superior mechanical strength, and other desirable characteristics and the development of methods for the synthesis of new graft and block polymers with the aim of developing novel materials with predetermined characteristics. In conducting work on these important aspects of the chemistry of polymers, practically all chemical institutes of the Academy of Sciences USSR and a number of institutes of the academies of sciences of the Ukrainian, Azerbaydzhan, Belorussian, Kirgiz, Armenian, Kazakh, Georgian, and Lithuanian Soviet Socialist Republics, as well as the Kazan', Ural, and Moldavian affiliates, will participate.

Topchiyev emphasized that no sufficient provisions have been made for work along some lines; for instance, only the Azerbaydzhan, Ukrainian, and Belorussian academies and the Kazan' Affiliate of the Academy of Sciences USSR propose to work on problems pertaining to the structure and properties of polymers. The provisions made for the investigation of reaction mechanisms are also inadequate.

Academician V. A. Kargin, chairman of the Scientific Council on the Problem of High-Molecular Compounds, outlined the functions of this council as a coordinating center and organization responsible for the dissemination of information, the calling of conferences, and consultations. Six sections have been organized within the council, viz., those of catalytic polymerization, monomers, synthetic fibers polymerized plastics, aviation materials, and the conversion of plastics [into finished products].

At present the council is preparing recommendations on research dealing with important applications of polymers such as the coating of metals to protect them from corrosion. The council has also considered problems pertaining to research on the synthesis of special fibers which have unusual mechanical characteristics and can be used within a wide range of temperatures. Research to be done on reinforced plastics was also considered.

Representatives of the academies of sciences of union republics and of affiliates of the Academy of Sciences USSR participated in a discussion in regard to measures that should be taken for the most expedient solution of problems set to science by the May 1958 Plenary

Session of the Central Committee of the CPSU. Academician A. Ye. Arbuzov, chairman of the Kazan' Affiliate of the Academy of Sciences USSR, touched on the question of the distribution of scientific personnel in connection with the expansion of work in the field of high-molecular compounds. He warned against attempts to ensure progress of this work by weakening research in other important scientific fields in which progress has already been made. A similar opinion was expressed by A. L. Mndzhoyan, vice-president of the Academy of Sciences Armenian SSR, who stated that in making the effort to expand research on polymers one must not forget other important fields of research in organic chemistry, specifically work on physiologically active compounds. A. T. Kyll', director of the Institute of Chemistry, Academy of Sciences Estonian SSR, discussed problems connected with the utilization of Estonian oil shale as a source of chemical crude materials. G. M. Shchegolev, director of the Institute of Thermal Power Engineering of the Academy of Sciences Ukrainian SSR, expressed the opinion that more attention should be paid in the tentative plan to the utilization of coke-chemical crude materials and solid fuel for the production of polymers. According to Shchegolev, work is being done at the Academy of Sciences Ukrainian SSR with the purpose of producing from the noncoking coals of the Donets Basin crude materials for artificial fibers and plastics. M. F. Nagiyev, vice-president of the Academy of Sciences Azerbaydzhan SSR; V. I. Nikitin, director of the Institute of Chemistry, Academy of Sciences Tadzhik SSR; R. D. Obolentsev, chairman of the Bashkir Affiliate of the Academy of Sciences USSR; N. F. Yermolenko, Active Member of the Academy of Sciences Belorussian SSR; Yu. Yu. Matulis, president of the Academy of Sciences Lithuanian SSR; S. A. Giller, Corresponding of the Member Academy of Sciences Latvian SSR; and Academician I. P. Bardin, vice-president of the Academy of Sciences USSR, also participated in the discussion.

At the end of the meeting, Academician A. N. Nesmeyanov, chairman of the Council on Coordination of Scientific Activities of Academies of Sciences of the Union Republics and Affiliates of the Academy of Sciences USSR stated that scientists, engineers, and designers must be mobilized for a concentrated effort in the chemical field. According to Nesmeyanov, all possibilities which are available must be utilized; this is the essence of coordination of research. He emphasized that in order to achieve progress in the chemistry of high-molecular compounds one must find new scientific forces rather than base one's efforts on those which are already being employed to advantage in research pertaining to other important fields that have already advanced and are now firmly established. According to Nesmeyanov, it would be inadvisable to destroy something that has already been organized or is being organized. For instance, at the Academy of Sciences Armenian SSR very productive work is being done on the chemistry of physiologically active compounds. The work in question is very promising and much has already been achieved in this

field. It would be wrong to set obstacles to the continuation of research conducted there and have the specialists working there do research on polymers.

Nesmeyanov also pointed out that it would be an error to disregard fields of research which have not been designated as being of the greatest importance at present. One must pay sufficient attention to research in the coke-chemical field and to work on naturally occurring substances such as cellulose, pentosans, and lignin. Extensive work in these fields is being done at the academies of sciences of the Uzbek, Latvian, and several other union republics. This work must be assisted in every respect. The Presidium of the Council on Coordination made a number of recommendations to the presidiums of the academies of sciences of union republics in connection with the increased concentration on work in the field of high-molecular compounds which is envisaged. In carrying out measures pertaining thereto, particular attention should be paid to the training of personnel in the fields of the chemistry and physics of high-molecular compounds.

13. R. Kh. Freydlina's Investigations on Organoelemental Compounds and Telomerization

"Election of Academicians and Corresponding Members of the Academy of Sciences USSR" (unsigned article); Moscow Izvestiya Akademii Nauk SSSR, Otdeleniye Khimicheskikh Nauk, No 9, Sep 58, pp 1135-1154

R. Kh. Freydlina is a prominent scientist active in the field of organic chemistry, specifically the chemistry of organoelemental compounds. Her research on the chemistry of substances of this class includes work on compounds of Mg, Hg, B. Tl, Si, Zr, Sn, Pb, As, and Sb. In the course of her work in the field of organoelemental compounds she has carried out a number of investigations on the chemistry of compounds derived from titanium, silicon, and multivalent iodine. The most extensive work done by Freydlina concerned telomerization reactions, transformations of telomerized products, and the application of reactions of this type in the industry.

Freydlina discovered a number of new and important methods of synthesis in the field of organometallic chemistry: she investigated the dual nature of saturated and unsaturated alpha- and beta-substituted aliphatic compounds of mercury, lead, and thallium and showed that these substances are true organometallic compounds rather than complex [addition] compounds. Freydlina subjected to detailed investigation the chemistry

of organic compounds of titanium, synthesized the first lower polymers of polytitanoxane, and developed the basic methods of synthesis to be applied in this field. Later, these methods were expanded to work on the chemistry of zirconium. In the field of silicon chemistry, Freydlina discovered the reaction of thermal telomerization of olefines with silicochloroform and with organic derivatives of silane. The new reaction makes it possible to synthesize novel siloxane polymers.

Investigation of the chemical transformation of ω, ω, ω, ω-tetra-chloroalkane telomers and related compounds enabled Freydlina to compare the chemical reactivity of different functional groups containing chlorine (dichloromethyl, trichloromethyl, trichlorovinyl, etc.) that are present in saturated and unsaturated compounds. Freydlina developed new methods for synthesizing from compounds containing different chlorine-substituted functional groups various polyfunctional organic substances useful as intermediate products for the production of synthetic resins, fibers, plasticizers, lubricants, and aromatic substances. As a result of her research, a new field of homolytic rearrangements of aliphatic compounds in solutions was opened up. Freydlina published altogether about 100 scientific works, including the monograph Sinteticheskiye Metody v Oblasti Khimii Metalloorganicheskikh Soyedineniy Myshyaka (Synthetic Methods in the Field of the Chemistry of Organometallic Compounds of Arsenic).

The results of scientific work done by Freydlina and the group directed by her are being introduced into industrial application; a new industrial process for the synthesis of ω-aminoenanthic and ω-aminopelargonic acids and by-products accompanying them was developed on the basis of this work. The new fibers named enant and pelargon are produced starting with these acids. At a general meeting of the Academy of Sciences USSR held on 20 June 1958, the election of R. Kh. Freydlina as a Corresponding Member of the Academy of Sciences USSR by the Department of Chemical Sciences in the specialized branch of organic chemistry was confirmed.

14. A Glass Cement for Aluminum and Light Alloys

"New Glass," by G. Alova; Moscow, Znaniye-Sila, Vol 33, No 8, Aug 58, p 23

At the Chair of Glass and Silicate Technology, Belorussian Polytechnic Institute imeni Stalin, new types of glass have been developed in work done under the direction of Academician M. A. Bezborodov, Academy of Sciences Belorussian SSR. With the use of a charge containing oxides of silicon, boron, aluminum, and magnesium, glass was developed which melts

at approximately 1,500°. This new glass has a coefficient of expansion which is approximately the same as that of quartz. Because of its low coefficient of expansion, glass of this type can stand sudden changes of temperature amounting to 220° without cracking.

By using a charge which contains cesium in addition to boron oxide and lead oxide, a glass was produced which has a coefficient of expansion 32 times higher than that of quartz. Glass of this composition melts more readily than aluminum. By adding silicon dioxide to the charge, one can reduce the otherwise high expansion of cesium. By varying the proportion of silicon, one can control the coefficient of expansion of the glass and produce glasses which have any desired coefficient of expansion. Glasses the heat expansion coefficient of which equals that of aluminum, duraluminum, magnesium, and other light metals and alloys can be obtained in this manner. Such glasses can be used as coatings protecting metals from corrosion, as lubricants and coolants in the extrusion of light metals and alloys, and as cement ("solder") for joining parts made of aluminum and light metals in general.

[For additional information on industrial chemistry, see Item No 10.]

Chemistry and Technology of Fuels and Propellants

15. Esters of Perchloric Acid

"Esters Formed by Perchloric Acid With Some Polyfunctional Alcohols; Part IV" by A. A. Zinov'yev, I. A. Zakharova, and G. P. Kondratskaya, Institute of General and Inorganic Chemistry imeni N. S. Kurnakov, Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 10, Oct 58, pp 2390-2394

Complete and incomplete esters of ethylene glycol, glycerine, and pentaerythritol with perchloric acid have been synthesized for the first time. The complete and incomplete esters of glycol and glycerine, which were obtained in the form of mixtures, are heavy (specific weight about 1.7) liquids difficultly soluble in water and readily soluble in diethyl ether. The corresponding esters of pentaerythritol are colorless solid substances. The esters of ethylene glycol, glycerine, and pentaerythritol with perchloric acid are unstable substances which explode with great violence on being subjected to heating, impact, or friction.

16. A USSR Bibliography on Reaction Engine Fuels

Reaktivnyye Topliva (Fuels For Reaction Engines); Moscow, Informatsionnyy Ukazatel' Bibliograficheskikh Spiskov i Kartotek, Sostavlennykh Bibliotekami Sovetskogo Soyuza (Informational Index of Bibliographies and Card Files Compiled by Libraries of the Soviet Union), No 9, Oct 58, p 26.

A bibliography of books and periodical articles published in Russian and languages other than Russian on the subject of reaction engine fuels during 1954-1958 was issued in May 1958 by the Central Scientific-Technical Library of the Petroleum Industry, Moscow, Dmitrovskiy 1-y proyezd, 10 (10 First Dmitrovskiy Drive). This bibliography lists 369 titles and is designated by the number 2073. Typewritten copies of bibliographies compiled by the library in question are supplied free of charge.

Radiochemistry

17. Review of USSR Work on the Application of Radioactive Isotopes

"Application of Radioactive Isotopes in the USSR", by A. V. Topchiyev, I. T. Alad-yev, and P. S. Savitskiy; Moscow, Atomnaya Energiya, Vol 5, No 3, Sep 58, pp 321-334

The first section of the article reviews the action of nuclear radiation on chemical processes, materials, and the organism, i. e., deals with work in the field of radiation chemistry. It is stated that the practical application of radiation-chemical processes involves the use of nuclear reactors, accelerators of charged particles, or radiation sources formed by radioactive isotopes or reactor fuel elements.

Work on radiation-chemical polymerization, oxidation of organic compounds, halogenation, cracking, and application of nuclear radiation for increasing the efficiency of catalytic processes is reviewed. In the section on radiation-chemical polymerization, the use of ionizing radiation for the synthesis of graft and block polymers is discussed. An investigation of the effect of gamma radiation on polydimethylsiloxane rubber in a helium atmosphere is described. It is pointed out that by the application of a dose of 100 mgrad [megarads] a thick vulcanization network can be produced in silicone rubber of this type, so that crystallization at low temperatures is suppressed entirely and the elastomer acquires a high degree of stability at low temperatures.

In the section on radiation-chemical halogenation USSR work on the radiation-chemical fluorination and introduction of fluorine-containing groups into benzene as a result of the action of radiation are described. According to the information given, carbon tetrachloride is fluorinated by means of inorganic fluorides. Benzene is reacted with CF_2Cl_2 or $C_2F_2Cl_3$ by irradiating the mixture. The review of the work in the field of radiation chemistry contains a discussion of the application of radiation for increasing the mechanical strength of metals. This review is concluded with a discussion of the use of radiation methods for the preservation of foodstuffs, in the production of natural silk, and in the biochemical synthesis of egosterol.

The second half of the article, which deals with the application of radioactive isotopes in research, control processes, and analysis, states that industrial application of isotopes made it possible to save 1.2-1.5 billion rubles in the USSR in 1957. Applications of radioactive isotopes in ferrous metallurgy; prospecting and production of petroleum; prospecting for minerals containing boron, carbon, lead, tungsten, mercury, antimony, and molybdenum; procedures for industrial control; chemical analysis and chemical work in general; flotation; and biological research are reviewed. In the section on chemical analysis, the application of radioactive isotopes in the separation of elements close to each other in chemical characteristics (e. g., rare-earth elements, niobium-tantalum-titanium, zirconium-hafnium) is pointed out. The application of radioactive isotopes in the determination of the purity of semiconductor materials and materials used for the construction of nuclear reactors is emphasized.

 The article is concluded with a section entitled "Some Information on the Production of Isotopes."

It is stated that more than 90 radioactive isotopes, 170 stable isotopes, and more than 360 tracer compounds are produced in the USSR. More than 100 types of radiation sources including sources based on the use of Co^{60}, Cs^{137}, Sr^{30}, Pm^{147}, Tu^{170}, Ir^{192} and Eu^{154} are produced. According to the text of the article, the following quantities of isotopes (in curies) will have been produced in the USSR in 1958:

Co^{60}	more than	190,000	Au^{198}	1,000
C^{14}		200	Ir^{192}	800
P^{35}		1,100	Cs^{137}	1,500
Sr^{35}		900	Tu^{170}	750
I^{131}		1,200		

Production of more than 70 new radioactive and stable isotopes and of 140-160 compounds derived from them will be started soon.

It is stated that methods for the separation of stable isotopes including electromagnetic separation, countercurrent diffusion, ion exchange, distillation, electrolytic methods, chemical exchange methods, and others are now being applied extensively in the USSR. The state of progress in this field is such that the USSR can separate and produce in considerable quantities stable isotopes of practically all elements.

Some stable isotopes (e. g., nickel and chromium) have been produced in the USSR in quantities of the order of kilograms. At present research work is being done on the development of methods for the production of monoisotopic materials to be used in the construction of nuclear reactors.

A bibliography consisting of 74 USSR references and non-USSR references is appended to the article.

18. Progress of Nuclear Science in China

"Achievements of Science and Technology in China" (unsigned article); Moscow, Promyshlenno-Ekonomicheskaya Gazeta, Vol 3, No 127 (427), 24 Oct 1958, p 4

According to the New China News Agency, 33 radioactive isotopes have been produced with the aid of the first experimental nuclear reactor installed in China, which is the most powerful in Asia. More than 100 isotopes will soon be produced.

The radioisotopes that are being produced include cobalt-60, sodium-24, phosphorus-32, and calcium-45.

Nuclear science and technology in China have reached in many fields a level corresponding to that attained in the rest of the world. For instance, the nuclear emulsion prepared in China is as good as that produced in England.

Counters of different types are being produced which are used for the determination of the type, energy, and intensity of various kinds of radiation and also telescopes which record the intensity of cosmic radiation.

The release of 100-channel and 50-channel pulse analyzers indicates that China has mastered the complex production techniques involved in nuclear electronics.

On the eve of the celebration of the anniversary of the People's Republic of China (1 October 1958) operation of a 4.5-mev betatron ("electron cyclotron") was begun at Peiping.

A number of metal oil-diffusion vacuum pumps made available since recently in China makes it possible to achieve very high degrees of evacuation. The largest of these pumps is capable of evacuating 40,000 liters of air per second.

In addition, production has been started of different spectrometers for the measurement of the intensity of radiation, of a millimicrosecond pulse oscilloscope capable of recording changes in nuclei taking place within one billionth part of a second, separators of isotopes, and other important equipment applied in nuclear science.

Physical Chemistry

19. Relation Between the Mobility of Ions in the Lattice of Oxides and the Velocity of Isotope Exchange

"The Question of the Connection Between the Mobility of Ions in the Lattice of Oxides and the Velocity of Isotope Exchange," by S. Yu. Yelovich and L. Ya. Margolis, Problemy Kinetiki i Kataliza (Problems of Kinetics and Catalysis), No 9, 1957, pp 129-132 and 134-142 (from Referativnyy Zhurnal -- Khimiya, No 17, 10 Sep 58, Abstract No 56791, by M. Sakharov)

"The kinetics of the interaction of CO with samples of MnO_2 (1) with various degrees of deviation from the stoichiometric composition at 20° and isotope exchange between CO and (1) under flow reaction conditions between CO and $O^{16}O^{18}$ were studied. Increased mobility of O atoms was established in the samples of (1) with insufficient O in the lattice. In connection with this, the discovered absence of a noticeable effect of the O content in the lattice of (1) on the speed of chemosorption of CO attests, in the author's opinion, to the fact that the diffusion of O does not appear to be a limiting factor in the chemosorption of CO. It was further established that the more O there is in the lattice, the greater the velocity of isotope exchange. The authors point out the importance of taking into consideration the degree of stoiehiometricity of the solid oxides both during the study of processes of isotope exchange and during the study of the mechanism of catalytic reaction by isotope methods."

Isotopes

20. Methods of Computing the Equilibrium of an Isotope Exchange Reaction

"Methods for the Statistical Computation of the Isotope Exchange Equilibrium in the Gas Phase,: by N. M. Tatevskiy, Problemy Kinetiki i Kataliza (Problems of Kinetics and Catalysis), No 9, 1957, pp 339-344 and pp 369-370 (from Referativnyy Zhurnal -- Khimiya, No 17, 10 Sep 58, Abstract No 56643, by I. Godnev)

"The method of computing the equilibrium constants of isotope exchange reactions proposed by the author (Zhurnal Fiz. Khimii, Vol 25, No 3, 1951, p 261; V. M. Tatevskiy and A. V. Frost, Vestn. MGU, No 12, 1947, p 113) and I. Bigeleison and M. Mayer (Journal of Chemical Physics, Vol 15, No 5, 1947, p 261) is generalized to cover the case of computing the anharmonicity of vibrations, the interaction of vibrations and rotations, and other correction factors. The generalization is expounded on the example of a molecule of a type of asymmetrical gyroscope. The equilibrium constant K_p of the isotopic reaction $\nu_1 A + \nu_2 \bar{B} + \ldots \nu_1 \bar{A} + \nu_2 B + \ldots$ (where A and $\bar{A}$, B and $\bar{B}$ are molecules of the same elemental composition containing different isotopes) is expressed in the form $K_p = \varphi_{\bar{A}A}^{\nu_1} \times \varphi_{\bar{B}B}^{\nu_2} \times \ldots$, where the function $\varphi_{\bar{A}A}$ represents a ratio of the sums of the states of the molecules $\bar{A}$ and A including the zero energy factors. In determining the type of the function $\varphi_{\bar{A}A}$, the different electron states of the molecules $\bar{A}$ and A, the anharmonicity of vibrations, and the interaction of vibrations and rotations are considered; moreover, the expression for the rotational sum according to the states derived earlier (K. E. Stripp and I. G. Kirkwood, J. Chem Phys., No 19, 1951, p 1131; (R Zh Khim, 1956, No 15532) is used. The expression obtained for $\varphi_{\bar{A}A}$ can be simplified by using the product rule of Redlich and Teller, assuming that this law is applicable with sufficient precision to the uncorrected (for anharmonicity) frequencies observed and to moments of inertia at a zero vibration level. As a result, expressions were obtained for $\varphi_{\bar{A}A}$ and K_p which permit the analysis of the effect of every vibration on the value of the function $\varphi_{\bar{A}A}$ and K_p. The final expression for K_p makes it possible to arrive at an approximate value for K_p even if, from the experiment, only the molecular constants of one pair of isotopic molecules (e. g., A. and B) are known. Such methods of estimation are discussed briefly at the end of the article."

21. An Improved Method for the Preparation of Perchloric Acid Anhydride

"Systems Consisting of Perchloric Anhydride and Water; Part 10," by A. A. Zinov'yev and V. Ya. Rosolovskiy, Institute of General and Inorganic Chemistry imeni N. S. Kurnakov, Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 10, Oct 58, pp 2382-2389

The melting points in the system Cl_2O_7 - H_2O were determined in the concentration range of 25-100 mol % of Cl_2O_7. It was established that a line of the crystallization of perchloric acid is absent in the melting point-composition diagram. It was furthermore established that minus 100° rather than minus 112° must be regarded as the melting point of anhydrous perchloric acid, contrary to data published in the literature. It was found with the aid of dilatometric measurements that the temperature of the polymorphic transformation of oxonium perchlorate equals minus 24.9°. The densities of the low-temperature and high-temperature modifications of oxonium perchlorate were determined and found to be 2.040 and 2.095 at minus 25°, respectively. Indications were obtained that there is a region of the separation of liquid phases in the concentration range of 55-100 mol % of Cl_2O_7. An improved method for the preparation of perchloric acid anhydride is proposed.

22. Thermographic Investigation of Bromoplatinie Acid

"Thermographic Investigation of Bromoplatinie Acid", by L. G. Berg, K. N. Mochalov, P. A. Kurenkova, and N. P. Anoshina, Izv. Kazansk. Fil. AN SSSR, Ser. Khim. N., No 4, 1957, pp 127-132 (from Referativnyy Zhurnal -- Khimiya, No 17, 10 Sep 58, Abstract No 56717, by Ye. Banashek)

"The process of dehydration of $H_2[PtBr_6] \cdot 9 H_2O$ (1) by sufficiently rapid heating proceeds in two stages without any evident decomposition of the complex. The thermal decomposition of the complex with the evolution of Br_2 does not occur at a sharply defined temperature. One may therefore conclude that (1) belongs to the category of unstable compounds which decompose at different temperatures depending

on the rate of heating. The endothermic effects (at 45 and 100°) correspond to incongruent melting of the substances. Data published in the literature on the evolution of H_2O, Br_2 and HB_r during melting were not confirmed. The relation of the dissociation pressure of (1) to the temperature represented as a dependence between lgP and 1/T is linear. From these data, with the aid of the approximate equation of Nernst, the authors calculated the heats of dehydration at 760 mm (Hg). For the first and second stages of dehydration, these values are 14.4 and 15.0 KCal/mol, respectively."

[For additional information on inorganic chemistry, see Item No 37.]

Miscellaneous

23. New Chemical Institutions for the City of Yaroslavl', RSFSR

"Reliable Raw Material Bases Are Needed for Chemical Expansion," by L. Oreshkov, deputy chairman, Yaroslavskiy Sovnarkhoz; Moscow, Sovetskaya Rossiya, 25 Sep 58, p 2

The expansion of the chemical industry in the Yaroslavl' Economic Administrative Region has made it necessary to establish the following chemical institutions in Yaroslavl': the Scientific Research Institute of Monomers for Synthetic Caoutchouc (Nauchno-Issledovatel'skiy Institut Monomerov dlya Sinteticheskogo Kauchuka); the Design Technological Institute of Equipment for Processing Plactics, Caoutchouc, and Rubber (Konstruktorsko-Tekhno-logicheskiy Institut Oborudovaniya dlya Pererabotki Plastmass, Kauchuka i Reziny); Scientific Laboratory (Nauchnaya Laboratoriya) to be under the Yaroslavl' Technical Institute for the Synthesis of Monomers and Polymers of Rubber; and a major branch of the Institute for Planning Establishments of the Paint and Varnish Industry (Institut po Proyektir-ovaniyu Predpriyatiy Lakokrasochnoy Promyshlennosti).

Already established is the All-Union Scientific Research and Design-Technological Institute of Asbestos Technical Products (Vsesoyuznyy Nauchno-Issledovatel'skiy i Konstruktorsko-Tekhnologicheskiy Institut Asbestovykh Tekhnicheskikh Izdeliy). This institute was formed on the base of the Central Scientific Research Laboratory of Asbestos-Technical Products (Tsentral'naya Nauchno-Issledovatel'skaya Laboratoriya Asbotekhnicheskikh Izdeliy) located in Yaroslavl'.

[For information on organic chemistry, see Item No 13; for information on luminophores, see Item No 36.]

III. ELECTRONICS

Communications

24. New Method of Facsimile Transmission

"Facsimile Radio Communication With a Transmitter Frequency-Modulated Carrier, by I. A. Dorrer, E. S. Soberayskiy, V. F. Lugovoy, and G. A. Aleksandrov; Moscow, Vestnik Svyazi, No 8, Aug 58, pp 5-8

In 1953 at the Chair of Radio Receiving Equipment, Moscow Electrical Engineering Institute of Communications, a theoretical investigation was conducted on application of various methods of modulation for facsimile transmission. On the findings of this research a facsimile system was developed which was installed on one of the longest facsimile transmission lines in the USSR.

The specific feature of the new system is the frequency modulation of the carrier wave at both transmitting and receiving ends. The advantages of the new system of facsimile transmission are greater speed of transmission of facsimile image, narrower frequency band required, and greatly improved equipment performance.

25. Pulse-Phase Modulation in Multiplex Radio-Relay Lines

"Problem of Threshold Signal Power in Multichannel Radio-Relay Lines Using Pulse-Phase Modulation," by G. V. Dlugach; Moscow, Radiotekhnika, No 10, Oct 58, pp 18-28

The article discusses the probability of false firing of a demodulator in pulse-phase modulated radio-relay lines, when the power in the pulse is reduced below a certain threshold value. The optimum position of the limiting line is independent of the pulse shape. However, dependence of the mean number of demodulator false firings on power in the pulse at the output of the receiver was established. Formulas were derived for calculation of the threshold value of power in the pulse for various values of frequency response of the i-f amplifier, shape of pulse, or for the pulse spacing factor (from 5 to 20).

The article analyzes the specific case of a radio-relay line when the bandpass of an i-f amplifier is selected such as to ensure the lowest power for the threshold pulse; in such a case the mode of detection had no effect on noise immunity. In actual practice, however, other considerations, such as freedom from frequent adjustment, should enter the problem of selecting the optimum i-f for amplifiers operating in pulse-phase modulated radio-relay lines.

26. Pulse Storage Reception Method

"Problems of Reception of Pulse Signals by the Storage Method," by M. K. Belkin and N. G. Gatkin; Moscow, Radiotekhnika, No 10, Oct 58, pp 14-17

The article discusses the advantages of reception of pulse signals by the method of storage in single-channel and two-channel receivers. The theoretical analysis of this problem has indicated that certain immunity to interference can be obtained when the pulse storage method is applied to a two-channel receiver.

To check these theoretical findings, a circuit was designed to prove the validity of such a condition. An audio-frequency pulse generator (IZG) was incorporated into this circuit: the generator frequency was varied from 5 to 30 kc and the pulse duration from 10 to 120 microsec. The signals from the pulse and noise generator were fed to two mixers. The signal thus mixed with the noise was amplified, then demodulated, averaged, subtracted in a difference device, and viewed on oscilloscope.

The results of numerous observations have shown that two-channel reception utilizing the pulse storage method is superior to conventional single-channel reception.

Instruments and Equipment

27. Integral Time Relay

"Integral Time Relay," by V. G. Madison, S. T. Nikiforov, and M. V. Shavel'zon; Moscow, Priborostroyeniye, No 10, Oct 58, pp 26-27

This integral time relay was designed primarily for the control of open-hearth furnace valves. Reversal of the valves takes place at certain time intervals depending on the absolute value and the rate of increase of temperature of the air preheating chambers.

In 1956 the Uralmetallurgavtomatika Enterprise produced its first series of IRV instruments and in 1957 it began their regular manufacture.

The IRV instrument consists of two units: time relay unit and switching unit, the latter being controlled by an automatic potentiometer which responds to the temperature in the air heating chamber. The automatic potentiometer (EP-120-1s) is connected to two radiation pyrometers (RP) installed in the regenerating chambers. The IRV integral time relay will maintain a linear relationship between the heating chamber temperature and the operating time of the relay.

Prolonged operation of the IRV relay systems on some of the open-hearth furnaces has proved their reliability and efficiency.

28. Zavoyskiy Method Applied to Study of Photoconductivity

"Application of Zavoyskiy Methodto the Study of Kinetics of Photoconductivity," by K. V. Andreyko and O. O. Galkin; Kiev, Dopovidi Akademii Nauk UkSSR, No 3, 1958, pp 247-250

To study the photoconductivity kinetics of semiconductors, the Zavoyskiy grid current method based on sensitivity of grid current to the watt current of the oscillator was applied. In this experiment the investigated semiconductor specimen was placed between the capacitor plates and was illuminated by modulated light. The changes in photoconductivity of the specimen caused by modulated illumination produced a proportional change in the grid current of the oscillator. This grid current was then amplified and recorded with an oscillograph.

From the shape of oscillograph curves cuprous oxide photo-conductivity was studied with respect to temperature variations.

29. Accurate Time Determination of Flat Shaped Signals

"Accuracy of Time Determination of Flat Shaped Signals," by V. I. Nikitenko, Leningrad Electrical Engineering Institute imeni V. I. Ul'yanov; Moscow, Radiotekhnika i Elektronika, No 10, Oct 58, pp 1280-1286

Time determination of widely spaced signals can be achieved with the aid of a singular narrow reference pulse or a series of such pulses. The leading edge of the first reference pulse coincides with the beginning of the oscillatory process in the circuit and it determines the time-position of a point of constant relative level, the latter being independent of the magnitude of measured signal. For precise measurement it is necessary to

estimate the inaccuracy in position of the reference pulse in relation to the time scale. Such an error depends on the duration of the reference pulse, but the reduction of the reference pulse width is limited by the value of parasitic parameters of the circuit.

This method assures great accuracy of time determination of nonperiodic and singular pulses, as well as periodic signals of any shape and repetition rate. The accuracy of determination depends but slightly on the magnitude of the signal.

Components

30. Theory of Molecular Oscillator

"Theory of the Molecular Oscillator and Fluctuation of Its Oscillations," by V. S. Troitskiy, Radiophysics Institute, State University imeni N. I. Lobachevskiy, Gor'kiy; Moscow, Radiotekhnika i Elektronika, No 10, Oct 58, pp 1298-1313

The article analyzes the operation of a molecular oscillator as a nonlinear self-oscillating system with one degree of freedom. Equations for steady state oscillations of a molecular oscillator, as derived by Basov and Prokhorov, were used in the analysis. Spectrum of frequency and amplitude fluctuation of oscillations in a molecular oscillator caused by the action of thermal noises in the oscillator circuit and the shot effect of the molecular stream were examined.

It was established that the spectral width of the line was determined primarily by the thermal effect. For the ammonia oscillator at room temperature the calculated width of the line was 10^{-4} cycles, which is much narrower than the line produced by the thermal noises in an equivalent tube oscillator. The narrowness of frequency land of the molecular oscillator is explained by the existence of the process of frequency self-regulation.

The research conducted has revealed that for the analysis of performance of a molecular oscillator it is useful to measure the dielectric constant of the excited gas, which will assist in studying the nonlinear oscillations in a molecular oscillator.

31. New Electromagnetic Oscillographs

"Electromagnetic Oscillographs With Loop Type Galvanometers," by L. A. Biber and Yu. M. El'kind, All-Union Scientific Research Institute of Electric Power, Ministry of Electric Stations; Moscow, Elektrichestvo, No 10, Oct 58, pp 70-72

Electromagnetic oscillographs with loop galvanometers are widely used in various fields of scientific and engineering endeavor. Recently, electromagnetic oscillographs with loop galvanometers were developed having natural frequencies from 1.25 to 10,000 cycles and current constants from 8.10^{-9} to 9.10^{-3} a.m per mm. The low frequency oscillographs (up to 600 cycles) have electromagnetic damping, while those of higher frequencies are equipped with fluid damping. Small dimensions of loop galvanometers have permitted construction of multichannel oscillographs: 9- and 12-channel units designated POB-9 and POB-12 (Institute of Physics of the Earth, Academy of Sciences USSR) and a 24-channel OT-24 type oscillograph ("Geofizika" Plant). These oscillographs have simple and reliable optical systems and a convenient time graduation in the form of thin straight transverse lines spaced at 0.005 or 0.01 sec.

These multichannel oscillographs permit simultaneous recording of a large number of electrical and nonelectrical magnitudes. Utilizing the integrating properties of an overdamped loop galvanometer, the All-Union Scientific Research Institute of Electric Power, in cooperation with the Institute of Physics of the Earth, has developed the "vibrograph" VDTs for recording vibrations in the frequency range from one to 200 cycles having an amplification factor of 500. Such a device can be used in studying transient processes in steam and hydraulic turbines.

32. Device for Recording of Infrasonic Waves

"We Can See Ultrasound," by Ya. Petrov; Moscow, Ogonek, No 43, Oct 58, p 29

Soviet Academician V. V. Shuleykin has studied the vortex air flow behind the sea waves which creates an infrasonic wave called "sea voice." He suggested that detection of such an infrasonic wave could serve as forewarning of an approaching storm.

The greater part of work in building instruments for studying the infrasonic wave was carried out at the L'vov Polytechnic Institute; an infrasonic wave measuring amplifier, frequency analyzer, and cathode-ray oscillograph were built here. Of great interest among these instruments is the magnetic sound recorder for recording and reproducing subaudio sound waves. Previous efforts of other scientists in this particular field have

failed consistently. In the new magnetic sound recorder the picked-up low-frequency sonic wave is converted into higher frequency. These higher frequencies are fed to an oscillograph on the screen of which are observed the infrasonic waves of various pitch.

Acoustics

33. Acoustical Method of Gas Analysis

"Method of Acoustical Gas Analysis," by O. I. Kuchmin, Yaroslavl' Technological Institute; Moscow, Akusticheskiy Zhurnal, No 3, Jul-Sep 58, pp 263-266

Gas analyzers based on measurement of sound velocity are divided into resonance and phase-difference types. In both cases the gas sample is enclosed in a tube connected to a sound generator and a sound pickup.

The resonance method is based on measurement of natural frequency of the tube filled with examined gas. The phase-difference method is based on measurement of the phase difference between the source sound wave and the sound wave at the pickup.

The experiment was conducted under actual industrial conditions and was applied primarily to the analysis of an oxygen-nitrogen system. The sound-frequency range used for the gas analysis was varied from 4,460 to 4,550 cycles. The accuracy of the acoustical method of gas analysis was found to be better than 0.3%, which is acceptable in industrial applications.

The author thanks L. A. Chernov, L. V. Krasheninnikova, L. A. Sokolova, and S. M. Paupu for their assistance in this work.

Computers

34. China Builds Universal Digital Computer

"China's First General-Purpose Digital Computer Completed," (unsigned article); Peiping, K'o-hsueh Hua-pao (Science Pictorial), No 9, Sep 58, pp 323

"A small-scale, general-purpose digital computer, China's very first, was recently built by the Institute of Computation Techniques, Academia Sinica, in collaboration with the Peiping Wire Communications Plant (北京有綫電廠) and related units. This achievement, made possible through Soviet technical assistance, is evidence that China has begun to build up research on computation techniques.

"The computer is named the Pa-i (1 August) Model. It consists of tens of thousands of components, including nearly 4,000 diodes and 800 electron tubes. Its manufacture and adjustment are much more difficult than for the analog computer and its range of applicability is much wider.

"Currently housed in the Institute of Computation Techniques, this general-purpose digital computer is ready to perform data processing and complex computations in many subjects, including short-range numerical forecasting, geodetic adjustments, stress analysis for dikes, unstable flow of river beds, aerodynamics, and engineering design."

Materials

35. Irradiation of Dielectric Materials

Photograph caption; Moscow; Promyshlenno-Ekonomicheskaya Gazeta, 10 Oct 58

Associates of the Scientific Research Physicochemical Institute imeni L. Ya. Karpov have developed a method to increase the heat resistance of polyethylene by means of irradiation with a cobalt isotope. This method of irradiation of polyethylene insulation increases its heat resistance from 80-100°C to about 150-180°C. Yu. Malinskiy, senior scientific associate and Candidate of Chemical Sciences, was one of the participants in the project.

36. Progress in Work on Scintillators

"A Conference on Scintillator Research," by V. I. Startsev and G. V. Chuchkin; Moscow, Khimicheskaya Nauka i Promyshlennost, Vol 3, No 4, Sep-Oct 1958, p 528

A new subdivision of science has been developed in the USSR, i. e., dosimetry of radiation emitted by radioactive substances on the basis of procedures employing the scintillation effect. As a result of research done in this field, an independent branch of the chemical industry has been created, i. e., that of the production of scintillating materials and scintillators (single crystals and liquid and plastic scintillators).

To produce materials of this type, initial chemical products are used which must be very pure.

At the end of 1957, the Second Scientific Conference on the Synthesis, Production, and Application of Scintillators was held at Khar'kov. This conference was organized by the Institute of Crystallography, Academy of Sciences USSR; the Institute of Chemical Reagents; and the All-Union Institute of Mineral Raw Materials. More than 230 specialists, including physicists, chemists, and representatives of 62 scientific institutes and industrial enterprises, participated in the work of the conference. Fifty-nine reports and communications on scientific research and experimental work dealing with the synthesis and application of scintillators as well as developmental work pertaining to photomultipliers were presented at the conference.

Subsequently to the first conference on the subject, which was held in October 1956, research on the synthesis of initial chemical products of high purity, the methods for growing crystals, the production of different scintillators, and the investigation of properties of scintillators as well as the development of equipment to be used in the recording of nuclear radiation by the scintillation method progressed further.

At present work in this field is conducted at a number of enterprises of the chemical industry and scientific research institutes active within the scope of this industry, the Academy of Sciences USSR, the Ministry of Geology and Conservation of Mineral Resources, higher educational institutions, and other organizations.

Research in the following fields elicited the greatest interest at the conference:

1. The effect of the temperature gradient on the distribution of impurities during the growth of single crystals. It was shown in work of this type under what conditions a uniform distribution of impurities can be expected (Institute of Crystallography).

2. Growing of single crystals of naphthalene to which anthranilic acid has been added. The scintillation characteristics of such crystals were investigated; it was shown that scintillators of this type may be used as substitutes for scintillators containing thallium or consisting of naphthalene combined with anthracene (Institute of Crystallography).

3. The phenomenon of light concentration in connection with the luminescence of solid and liquid scintillators. The results of work in this field made it possible to establish the most advantageous form of crystals and the optimum distribution of impurities in them (Khar'kov Affiliate of the Institute of Chemical Reagents).

Furthermore, information was given on a number of new alkali metal halide phosphors which are of great importance (All-Union Institute of Mineral Raw Materials); on new boron-containing luminophores for slow neutrons developed at the Institute of Organic Chemistry, Academy of Sciences USSR, and the Engineering-Physical Institute; on the properties of scintillators of a new type; on scintillating glasses; etc.

Also, the results of many investigations pertaining to the synthesis of a number of new organic luminophores and the investigation of plastic, film, and other scintillators were reported.

The conference noted that, notwithstanding the considerable progress achieved by scientific research organizations and industrial enterprises in this field, the production of scintillators does not satisfy the demand for them.

To expedite further work in the field of scintillators, the conference proposed that scientific research organizations and industrial organizations concentrate on the development of production methods for the growing of large crystals to be used as phosphors, organization of the industrial production of plastic scintillators, improvements in the packing of scintillator crystals, and expansion of research on the physical properties of scintillators.

A new scientific technical council has been organized at the Khar'kov Affiliate of the Institute of Chemical Reagents. This council will make recommendations concerning the coordination of plans pertaining to scientific research and experimental work on the synthesis, production, and application of scintillators.

37. Single Crystals of Cadmium Sulfide and Cadmium Selenide

"A Method for the Preparation of Single Crystals of Cd S and Cd Se and Mixed Single Crystals of CdS + CdSe," by I. B. Mizetskaya, A. P. Trifimenko, and F. E. Fursenko, Physics Institute, Academy of Sciences Ukrainian SSR; Moscow, Zhurnal Neorganicheskiy Khimii, Vol 3, No 10, Oct 58, pp 2236-2239

On the basis of the experimental results described, a method for the preparation of single crystals is proposed which makes it possible to prepare in a reproducible manner and in sufficient quantities single crystals of cadmium sulfide, cadmium selenide, and mixed single crystals of cadmium sulfide and cadmium selenide exhibiting satisfactory photoelectric characteristics. In addition to well-formed single crystals, a considerable quantity of powder is formed and also small crystals which cannot be used as photoresistances. The fact that the products obtained are not homogeneous has

been confirmed by the results of physical and chemical investigations of the properties of the products and represents a shortcoming of the method described. To achieve further improvement of the method, subsequent work must aim chiefly at the synthesis of more homogeneous single crystals.

[For additional information on electronics materials, see Item No 9.]

Miscellaneous

38. Gold Medal Prize imeni A. S. Popov

"Competition for Gold Medal imeni A. S. Popov" (unsigned article); Moscow, Radiotekhnika, No 10, Oct 58, p 2

"The Department of Technical Sciences, Academy of Sciences USSR, announces that in 1959 a competition will be conducted for the Gold Medal imeni A. S. Popov which will be awarded for outstanding scientific work or invention in the field of radio.

"The right to competition for the Gold Medal imeni A. S. Popov will be open to Soviet as well as foreign scientists. The competition is open only to individuals.

"Works can be submitted to scientific institutions, design bureaus, higher educational institutions, scientific and engineering-technical societies, honorary members, and active members and corresponding members of the Academy of Sciences USSR.

"Only the published works can be submitted for the competition. The works will be submitted in triplicate in any language. It is also necessary to submit materials concerning the review of these works by scientific societies, an abstract of not more than one fourth of an author's sheet, and a concise biography of the candidate for the medal, with a list of his main works and inventions.

"The work, with the inscription 'For Competition for Gold Medal imeni A. S. Popov,' should be directed to the All-Union Scientific Council on Radio-physics and Radio Engineering of the Academy of Sciences USSR, Moscow, K-9, Mokhovaya, d. 11.

"The final date for submitting works is 1 February 1959.

"Information by telephone B 9-70-88. -- Department of Technical Sciences, Academy of Sciences USSR."

39. Recent Soviet Patents in the Field of Electronics

"Class 21. Electrical Engineering" (unsigned article); Byulleten' Izobretenii, No 5, 1958, pp 47-78

Class 21a, 32_{40}. No 112778 -- B. V. Krusser and G. A. Morozov; Transmitting Television Tube

Class $21a^1$, 13_{02}. No 113135 -- B. N. Petrovskiy and Ye. M. Martynov; Circuit of Multistage Electron Storage Unit for Telegraph Pulses

Class $21a^1$, 33_{50}. No 113083 -- D. G. Kats and L. Ya. Yampol'skiy; Pulse System of Television Receiver Automatic Gain control

Class $21a^1$, 34_{11}. No 113215 -- I. P. Zhukov; Method of Brightness Control in Oscillograph Cathode-Ray Tubes

Class $21a^2$, 5_{06}. No 112962 -- A. D. Tkachenko; Noise-Free Microphone

Class $21a^2$, 6. No 112992 -- A. N. Radchenko; Binary Relay Scaler Device

Class $21a^2$, 37_{03}. No 112996 -- V. A. Nyurenberg; Compression Method of Speech Frequency Spectrum

Class $21a^4$, 8_{01}. No 113100 -- S. I. Tetel'baum; Method of Generating SHF Oscillations and Oscillators to Generate Them

Class $21a^4$, 14_{01}. No 112733 -- N. F. Vollerner; Device for Stabilizing Modulation Characteristics of Frequency-Modulated Tube Oscillator

Class $21a^4$, 46_{06}. No 113222 -- V. D. Kuznetsov; Cophasal Multiple Horizontal Wide-Band Antenna

Class $21a^4$, 66_{05}. No 112601 -- B. Ye. Kinber and I. K. Berkovskiy; Movable Periscopic Antenna Array

40. Activities of Institute of Terrestial Magneism, Ionosphere, and Radio Wave Propagation

"At the Institute of Terrestial Magnetism, Ionosphere, and Radio Wave Propagation," by A. V. Gorokhovskiy; Moscow Vestnik Svyazi, No 10, Oct 58, pp 13-15

In the vicinity of Krasnaya Pakhra, not far from Moscow, located on a large plot of ground, is the Scientific Research Institute of Terrestial Magnetism, Ionosphere, and Radio Wave Propagation (NIZMIR) of the Ministry

of Communications. Many geophysical problems of great practical significance are being studied here. The institute has two branches, in Leningrad and Murmansk, and a number of ionosphere, magnetic, and cosmic stations.

The institute is concerned with problems of the study of the ionosphere and its forecasting, atmospheric disturbances, propagation properties of long and medium radio waves, terrestical magnetic fields, ground conductivity to radio waves, etc.

Among the prominent members of the institute are N. V. Pushkov (director), Yu. D. Kalinin, N. P. Bel'kova, Ya. L. Al'pert, E. I. Mogilevskiy, V. P. Orlov, S. Sh. Dolginov, Ya. I. Likhter, V. Ye. Kashprovskiy, and V. F. Shel'ting.

41. New Czechoslovak Electronics Research Institute Opened

"Additional Expansion of Our Electronic Research" (unsigned article); Prague, Obrana Lidu, 18 Sep 58, p 5

On 20 September 1958, the new A. S. Popov Research Institute for Communications Engineering (Vyzkumny Ustav Sdelovaci Techniky A. S. Popova) was opened in Prague-Branik. The institute will be one of the largest electronics research establishments in Czechoslovakia. New electronic products, which will be developed at the institute, will be produced by Czechoslovak industry, and emphasis will be placed on the solution of problems involving special materials and parts used in electronics and allied fields.

42. Turbine Testing at the Kuybyshev Hydroelectric Station

"Tests at the Kuybyshev Hydroelectric Station," by Yu. Ye. Gurkavi; Leningrad, Energo-Mashinostroyeniye, No 8, Aug 58, p 44

The Leningrad Metals Plant conducted during January-March 1958 a series of tests with the hydraulic turbine governor at the Kuybyshev Hydroelectric Station.

Other tests consisted in checking the possibility for further increase in turbine rating through changes in the combinatory curves, determination of moment of force acting on each guide vane, determination of behavior of guide vanes after alteration of their shape, and determination of number of complete turns required to bring the turbine to its full operating speed.

The results of these tests are now processed and will be published later.

It was established that the response of the governor to the speed control of the turbine was from 0.1 to 0.08%.

43. Increased Industrial Consumption of Natural Gas in USSR

"Utilization of Natural Gas as Industrial Fuel," by K. F. Roddatis; Moscow, Teploenergetika, No 11, Nov 58, pp 3-9

"As a result of geological prospecting conducted during the past 10-15 years more than 160 natural gas fields were discovered in our country, which places the USSR now among the leading nations with respect to natural gas reserves.

"During 1957, in various parts of our country there were discovered 14 new fields and 20 locations in previously discovered natural gas fields. According to preliminary estimates, our country has reserves of several tens of trillions of cubic meters of natural gas. During the past 10 years the commercial reserve of natural gas has grown to approximately ten times the previous level.

"Utilization of gas in various industries will not only increase the thermal efficiency, reduce operating expenses of industrial processes, and permit more accurate control and full automation, but will also increase the output of existing installations and improve working conditions.

"Thus, for instance, according to Ginromez calculations, a change in the existing open-hearth furnaces to natural gas firing will increase annual steel production by 2.5 million tons; a change to natural gas firing in cement rotary kilns would increase production by about 10%.

"Notwithstanding an increase in consumption of natural gas by thermal electric stations to many times the 1940 level, or to about five times the 1955 level, the ratio of natural gas consumption to total fuel consumption remains comparatively small, not exceeding 10%. Only by the end of the current Seven-Year Plan is it intended to increase specific gas consumption, as compared with total fuel consumption by electric stations, to 15%."

44. New Dynamic Test for Metals

"New Method of Dynamic Testing of Metals," by Ye. G. Konovalov and V. I. Yefremov; Minsk, Doklady Akademii Nauk BSSR, No 7, Aug 58, pp 283-287

Results are given for tests to determine the effect of acceleration of applied loads on the mechanical strength of metals. Ultrasonic vibrations of 40.5 kc with an amplitude in the 0.025-0.03 mm range provided an acceleration of loading of approximately 4,000 m/sec^2 in tests with one-mm-diameter wires of brass L-59 (58.9% Cu; 40% Zn; 0.9% Pb). Wire lengths were in multiples of one fourth the ultrasonic wavelength in brass at a frequency of 40.5 kc.

Brass specimens subjected to accelerated loading showed a 50% drop in all mechanical strength characteristics as compared with those in static loading. It was noted that rupture could occur due to internal stresses developing from critical acceleration of the specimen mass itself without supplementary outer loading. The authors feel that acceleration of applied loads may be an important criterion in dynamic strength of metals. This work is considered as but the beginning of studies in this field.

45. Performance of Steels at Superhigh Temperatures and Pressure

"Experience in the Use of Steam Pipes and Steam Superheaters Made of Steel EI257 at the Cherepet'skaya State Regional Electric Power Station," by L. P. Trusov, Candidate of Technical Sciences; Leningrad, Energomashinostroyeniye, No 8, Aug 58, pp 20-25

Certain results are given as to the performance of high-temperature materials, particularly steel E1257, in the first 3 years of operation at the Cherepet'skaya State Regional Electric Power Station (GRES No 19 of the Moscow Power System).

Design of basic equipment for GRES No 19 was completed in 1948-1950. Austenitic steels were to be incorporated in all basic components, since industry did not possess perlitic steels of sufficient quality. Problems associated with the search for and testing and development of high-temperature materials for GRES No 19 were assigned to and developed by the Division of Welding, the Division of Strength, the divisions OZhS, OMiT, OKiP, OPS, and OMS (designations not given) and other divisions of the Central Scientific Research Institute of Technology and Machine Building (TsNIITMash). The following recommendations were made by TsNIITMash: austenitic steel LA-1 for large cast components, perlitic steel 16GNM for boiler drums, austenitic steel EI257 for steam pipes and steam superheaters, and electrodes TsT-7 for arc welding of austenitic steels. Processes were also developed at TsNIITMash for contact welding of tubing made of steel EI257 and composite tubing (EI257 + 15KhM).

The first unit of GRES No 19 (consisting of boiler TP-50 and turbine SVK-150-1) with superhigh steam parameters (170 atm and 550°C) was activated in December 1953. Use of steel EI257 in the convection superheater of this and subsequent units was based on successful operation of an experimental boiler (300 atm and 600°C) at the All-Union Heat Engineering Institute imeni Dzerzhinskiy. Tests with this experimental boiler were completed in 1948.

Analysis of performance data by TsNIITMash proved steel EI257 to be generally satisfactory. Tubing rupture was due mainly to fatigue failure in work hardened portions. Heat-treatment of stressed areas removed the major cause of failure.

The necessity of stabilization of the structure of austenitic steels with either titanium or niobium was proved in the substitution of steel 1Kh18N12T for steel EI257 in steam pipes and superheaters in one of the units of GRES No 19.

46. Hot Machining of High-Manganese Steel

"Machining of Manganese Steel G12 in a Heated State," by V. G. Lyubimov; Moscow, Stanki i Instrument, No 7, Jul 58, pp 27-29

Results given on investigations in machining of the high-manganese steel G12 (1.27% C, 12.63% Mn, 0.41% Si, 0.052% P, 0.016% S, 0.045% Cr, and 0.15% Ni) in a heated state with temperatures up to 700°C indicate that highest efficiency is attained when steel temperature is 500°C.

Cutting speeds ranged from 58 to 75 m/min with cutting depths of 1-5 mm and tool feed rate of 0.1-0.5 mm/rev. Cutting tools (made of plates of the hard alloy T15K6) were serviceable for 30 minutes (compared with the one-minute life period with steel at room temperature). Tests with cutting speeds of 86 m/min showed only 1.8 mm of tool wear (1.5-2.0 mm established as maximum wear) and a similar 30-minute life period indicating the possibility of increasing given machining values 30-35%. Machining time was less by a factor of 10 when feed was increased to one mm/rev. Further increase of feed proved unsatisfactory due to poor machined surface quality.

Tool feed can be increased up to 5-8 mm/rev with a cutting tool of a design by V. A. Kolesov and machining time correspondingly decreased by a factor of 150-250. Even higher cutting speeds are possible with powder ceramic tools TsM322 at feed rates of 0.1-0.7 mm/rev, cutting depths of 1-5 mm, and tool pressure of 200-250 kg with no chipping or breaking of the tool.

47. Electrospindle With High-Speed Aerodynamic Bearings

"Aerodynamic Bearings for High-Speed Motors and Turbines," by S. A. Sheyberg, Doctor of Technical Sciences, and A. M. Kharitonov, Candidate of Technical Sciences; Moscow, Vestnik Mashinostroyeniya, No 9, Sep 58, pp 14-17

A description is given of the design and operation of the aerodynamic bearings in the electrospindle ESh-119. The device is designated for polishing inner surfaces with diameters up to 25 mm. Technical specifications are as follows: power, one kw; voltage, 220 v; current, 3.9 amp; power factor, 0.85; efficiency, 80%; speed of rotation, 40,000 rpm (uniform); rotor diameter, 49.5 mm; and journal diameter, 32 mm. At constant rotation the speed at the surface of the rotor is 124 m/sec and 80 m/sec at the journal surfaces. The product Dn (D = diameter of journal in mm, n = rpm) is three times greater than that for ball bearings.

Compressed air or gas forced into the bearing clearances acts as a cushion on which the journals ride. At a pressure of 3 atm and with a minimum clearance of 4 microns the carrying capacity of the bearing (diameter of 32 mm and length of 55 mm) is 85 kg and 30 kg at one atm pressure. Bearings are made of the special graphite material Ye which is manufactured at the Moscow Electrode Plant for aerodynamic bearings.

Initial work on electric motors with aerodynamic bearings was begun at the Experimental Scientific Research Institute of Metal-Cutting Lathes. The ESh-119 electrospindle was developed by the authors in 1957 and incorporates corrections to earlier design deficiencies.

A description is also given of a balancing machine which permits balancing accuracy within limits of 0.02 gcm.

48. New Commission on Industrial Heating

"At State Scientific Technical Committee of the Council of Ministers USSR," by M. P. Chuvilkin; Moscow, Teploenergetika, No 11, Nov 58, p 94

At the State Scientific Technical Committee there was organized a Commission on Industrial Heating, whose function it will be to work out suggestions and recommendations to assist the development of industrial and centralized heating, design of new types of turbines, boilers, auxiliary equipment, and heating systems.

The new commission will be headed by Dr S. F. Kop'yev. Other members of the Commission will be N. K. Gromov, V. K. Dyuskin, A. N. Kuranov, L. A. Melent'yev, A. A. Nikolayev, V. B. Pakshver, Ye. Ya. Sokolov, M. P. Chuvilkin (scientific secretary), Ye. O. Shteyngauz Ye. P. Shubin (deputy director), and L. K. Yakimov.

One of the main aims of the commission will be the settlement of disputable problems in heating and the formulation of unified recommendations.

The work of the commission will be presented in the periodical press.

[For additional information (water problems at atomic electric power plants), see Item No 10.]

V. MATHEMATICS

49. Fourier Series

"On Series According to a Rearranged Trigonometric System," by P. L. Ul'yanov; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Matematicheskaya, Vol 22, No 4, Jul/Aug 58, pp 515-542

It is proved that several properties of trigonometric series (Fourier series) are not transferred to series formed by rearrangement of a trigonometric system.

The work consists of four parts.

In the first part two sufficient conditions are given for the almost everywhere absolute convergence of Fourier series.

In the second part the summability of series (Fourier series) having the form

$$a_0/2 + \sum_{\nu=1}^{\infty} (a_\nu \cos k_\nu x + b_\nu \sin k_\nu x)$$

is considered where the natural numbers k are all different. It is proved that the Fourier series according to the rearranged system $\{\cos k_\nu x, \sin k_\nu x\}$ cannot in fact be summed by the powerful methods of Tyoplits. Two theorems and a number of remarks and corollaries are devoted to this question.

An analogous result for complex power series is also proved.

In Part 3 the rearranged trigonometric system $\{\cos k_\nu x \sin k_\nu x$ is considered from the aspect of convergence of Fourier series formed according to this system from the functions $f(x) \in L^p(0, 2\pi)$, where $1 \leq p < 2$. In addition, the question concerning convergence on the interval $[0, 2\pi]$ according to the metric L^q $(q > 2)$ of Fourier series according to the system $\{\cos k_\nu x, \sin k_\nu x$ from continuous functions is considered.

Toward the end of Part 3 the complex analog is given.

In Part 4 a number of corollaries of the theorem proved in Part 3 is derived which may command independent interest. For example, it is proved that a rearranged trigonometric system, generally speaking, is not a base in the space $L^p(0, 2\pi)$ for $p \in [1, 2) + (2, \infty)$.

50. Elliptic Equations and Systems

"A Priori Estimates in L_p and Generalized Solutions for Elliptic-Equations and Systems," by A. I. Koshelev; Moscow, Uspekhi Matematicheskikh Nauk, Vol 13, No 4 (82), Jul/Aug 58 pp 29-88

The first boundary value problem with homogeneous boundary conditions for elliptic equations or systems is considered. The existence of a general solution and its differential properties are obtained with the help of a priori estimates and the method of continuation according to the parameter, based on the applied system of the Newton method.

The paper consists of three parts.

The first part has a subsidiary character and contains a series of reductions from the analysis of functions, Fourier transforms, etc.

The second part is devoted to the obtaining of an a priori estimate in L_p indicated above for linear equations or systems. This estimate is first obtained for equations having constant coefficients and then it is extended for the case of variable coefficients sufficiently smooth. Paragraph 4 of the second part is devoted to equations of the second order. This paragraph contains a short survey of the results obtained by various authors, and the idea of the proof of the indicated estimate. The proofs conducted for one equation, the author says, are easily extended for a random case. The reader unfamiliar with elliptical systems is advised that he may omit the paragraph during reading.

The third part is devoted to the fundamental theorem concerning the existence of the general solution for elliptic equations (systems). Here is given the method of continuation according to the parameter with utilization of the system of the Newton method. In Paragraph 12 of this part a theorem concerning the existence of the general solution for a particular class of nonlinear equations (systems) is obtained.

For understanding of the paper the reader must be familiar with the scope of the first chapters of the monographs by L. A. Lyusternik and V. I. Sobolev, Elementy Funktsional'nogo Analiza (Elements of Functional Analysis), Moscow-Leningrad, Gostekhizdat, 1951, and of the first chapter of the monograph by S. L. Sobolev, Nekotoryye Primeneniya Funktsional'nogo Analiza v Matematicheskoy Fizike (Several Applications of Functional Analysis in Mathematical Physics), Leningrad State University, 1950.

51. Best Approximation for Differential Functions

"Theorems Concerning the Uniqueness of the Best Approximation for Differential Functions," by A. L. Garkavi; Moscow, Uspekhi Matematicheskikh Nauk, Vol 13, No 4 (82), Jul/Aug 58, pp 225-226

The following is the text of the article.

We denote by C_s the class of functions having a continuous derivative of the s-th order on the interval [a,b]. Let $S_n = \{\varphi_1(x), \ldots, \varphi_n(x)\}$ be a system of linearly independent functions belonging to the class C_s, and $L_n = L(S_n)$ the space of polynomials according to that system.

The question concerning the dimensionality of the polyhedrons of the elements of the best uniform approximation for functions of the class C_s is considered in the space L_n.

We will denote the Tchebycheff rank of the space L_n by $R(L_n)$, i.e., the maximum dimensionality of the polyhedrons of the best approximation for continuous functions, and the Tchebycheff rank of L_n relative to the class C_s by $R(L_n, C_s)$, i.e., the maximum dimensionality of the indicated polyhedrons for functions from the class C_s.

Theorem I. In order to satisfy the inequality

$$R(L_n, C_s) \leq r \qquad (s \geq 1)$$

it is necessary and sufficient that the mean of the general zeros of every k linearly independent polynomials from L_n $(k=r+1,\ldots,n)$ contains not more than n-k points, appearing as general double or boundary zeros of the r+1-th of the indicated polynomials.

This theorem for $r = 0$ gives the necessary and sufficient conditions that for any $f(x) \in C_s$ in the space L_n there exists a unique polynomial of the best approximation.

Corollary I. For any $s \geq 1$ $R(L_n, C_1) = R(L_n, C_s)$.

Corollary II. The inequality

$$R(L_n, C_1) \geq 2R(L_n) - n - 1 \text{ holds.}$$

Corollary III. Let m be the greatest number of zeros (considering their multiplicity), which may have a nontrivial polynomial from L_n; then

$$R(L_n, C_1) = 0 \quad \text{for } R(L_n) \leq [(2n-m-1)/2],$$

and

$$R(L_n, C_1) \leq m + 1 - 2[n - R(L_n)] \quad \text{for } R(L_n) > [(2n-m-1)/2].$$

The criterion, mentioned in Theorem 1, is simplified for the following case.

Let L_n^* have an n-dimensional hyperplane (in particular a subspace) of the space L_{n+1} $L(T_{n+1})$, where T_{n+1} has a Tchebycheff differential system on the interval [a,b] such that for any interior point of [a,b] there exists a polyhedron having a simple zero. (The approximating systems of Tchebycheff generally encountered satisfy this condition.) Under these assumptions the following theorem holds:

Theorem II. For the inequality $R(L_n^*, C_1) \leq r$ to be satisfied it is necessary and sufficient that for any j of the boundary points (j = 0, 1, 2) and $P_j = [1(n-r-j)/2]$ of the interior points of the interval [a,b] there exists a polynomial from L_n^* assuming at those points values of any signs given in advance.

Theorem II indicates, in particular, the sufficient conditions for uniqueness of the polynomial, least differing from zero, among the polynomials of $L(T_{n\,1})$, the coefficients of which are linked by certain linear relations.

52. Approximation of Functions by Ordinary Polynomials

"Concerning the Approximation of Functions by Ordinary Polynomials on a Finite Segment of the Real Axis," by V. K. Dzyadyk; Izvestiya Akademii Nauk SSSR Seriya Matematicheskaya, Vol 22, No 3, May/Jun 58, pp 337-354

Several kernals are brought into consideration in the paper, with the help of which a method is indicated for which continuous functions given on the segment [a,b] by sequences of polynomials permit one to realize further investigation along the directions first indicated by S. M. Nikol'sky and subsequently by A. F. Timan and the author.

53. Spectrum Discreteness of a Differential Operator of the Second Order

"Concerning the Spectrum Discreteness of a Differential Operator of the Second Order," by F. G. Maksudov, Physicomathematical Institute; Baku, Doklady Akademii Nauk Azerbaydzhanskoy SSR, Vol 14, No 9, 1958, pp 667-671

The operator L, generated by the differential expression

$$l(y) = (-1)^n \frac{d^n}{dx^n}\left(P_0 \frac{d^n y}{dx^n}\right) + (-1)^{n-1}\left(P_1 \frac{d^{n-1}}{dx^{n-1}}\right) + \ldots + P_n y,$$

in the Hilbert space $L_2(-\infty, +\infty)$ is considered.

The functions $y(x) \in L_2(-\infty, +\infty)$ absolutely continuous in every finite interval $[-a, a]$ $(a > 0)$ together with their quasi derivatives up to the 2n-1 order and those $l(y) \in L_2(-\infty, +\infty)$ are contained in the region of definition D_L of the operator L.

The criteria for pure discreteness of the spectrum of the operator L were established using the method of A. M. Molchanov.

The following theorem was proved:

Let $1/P_0$, $P_1, \ldots, P_n$ be real, positive, locally summable functions such that

1. for N sufficiently large the functions $P_0, \ldots, P_{n-1}$ are continuous in the intervals $(-\infty, N)$ and (N, ∞),

2. the limits $\lim_{|x|\to\infty} P_0(x) = a_0, \ldots, \lim_{|x|\to\infty} P_{n-1} = a_{n-1}$ exist where $a_0 \neq 0$.

3. $P_{n-1} \geq 1$, and P_n is bounded on the entire real axis and $P_n > 1$.

Then the spectrum of the operator L is purely discrete then and only then, when for any fixed number x

$$\lim_{|x|\to\infty} \int_x^{x+\pi} P_n(x)\,dx = \infty.$$

54. Nilpotent Groups

"Generalized Solvable and Nilpotent Groups," by B. I. Plotkin; Moscow, Uspekhi Matematicheskikh Nauk, Vol 13, No 4 (82) Jul/Aug 58, pp 89-172

The table of contents accompanying the article follows.

Approved For Release 1999/09/08 : CIA-RDP82-00141R000100200001-1

Part V. The structure of subgroups of generalized solvable and nilpotent groups

Section 21. Structural properties
22. Structure of the subgroups of a locally nilpotent group
23. Structure of the subgroups of a radical group

A bibliography is given of 207 entries.

55. The Problem of Homeomorphism and the Theory of Algorithms

"Insolubility of the Problem of Homeomorphism," by A. A. Markov; Moscow, Uspekhi Matematicheskikh Nauk, Vol 13, No 4 (82) Jul/Aug 58, pp 213-216

The following are the opening paragraphs.

"1. We will call the problem of research of algorithms, distinguishing whether any two given polyhedrons are homeomorphic or not, a general problem of homeomorphism. Herein polyhedrons are given as combinations of their triangulations, which gives the possibility here of understanding the term 'algorithm' in its exact sense, i.e., for example as 'normalized algorithm.' (See "Theory of Algorithms," A. A. Markov, Trudy MI AN SSSR, 42, 1954.)

"Along with the general problem of homeomorphism naturally arise various particular problems of homeomorphism pertaining to polyhedrons of this or another class. It is possible, for example, by fixing the natural number n, to present the problem of homeomorphism for polyhedrons of solvability not greater than n. It is also possible to present the problem of homeomorphism for n-dimensional manifolds if the term 'manifold' is placed in the definition of the concept.

"Another natural restriction assumed during the comparison of polyhedrons is the fixation of one of them. Herein, the problem of homeomorphism rises for the given polyhedron A consisting, in the search, of the algorithm discriminated for any polyhedron whether the polyhedron A is homeomorphic or not.

"Several of these problems have long been solved; for example, the problem concerning the homeomorphism of two-dimensional manifolds or the problem concerning the homeomorphism of a given two-dimensional manifold. However, the following statements hold:

"Theorem 1. For any natural number n greater than three, it is possible to indicate such an n-dimensional manifold M^n, such that the problem of homeomorphism of the manifold for the manifold M^n is insolvable.

"We understand the term "manifold" in the sense of H. Poincare, (Complement a l'analysis situs, Rend. Circolo Mat. Palermo, 13, 1899, 285-343), and O. Veblen (Analysis Situs, New York, 1931).

"Corollary 1. The problem of homeomorphism for n-dimensional manifolds is insolvable for n greater than three.

"Corollary 2. The problem of homeomorphism for polyhedrons of dimensionality not greater than n is insolvable for n greater than three.

"Corollary 3. The general problem of homeomorphism is insolvable.

"In 2. theorem 1 is proved.

"3. The problems of homotopic equivalence may be presented analogously for the problems of homeomorphism. Their formulations are obtained from the formulations for the problem of homeomorphism by means replacing the words 'are homeomorphic,' 'is homeomorphic,' by the words 'are homeomorphic equivalent,' 'is homeomorphic equivalent.' But such a replacement, naturally, is possible in two lemmas proved in 2° which gives the following results:

"Theorem 2. For every natural number n, greater than three, the problem of homotopic equivalence of manifolds for the manifold M^n is insolvable.

"Corollary 1. The problem of homotopic equivalence for n-dimensional manifolds is insolvable for n greater than three.

"Corollary 2. The problem of homotopic equivalence for polyhedrons of dimensionality not greater than n is insolvable for n greater than three.

"Corollary 3. The general problem of homotopic equivalence is insolvable."

56. Algorithms Shown Related to Partially Recurrent Functions

"On the Determination of Algorithms," by A. N. Kolmogorov and V. A. Uspenskiy; Moscow, Uspekhi Matematicheskikh Nauk, Vol 13, No 4 (82), Jul/Aug 58, pp 3-28

The above work had in view the possibility for a wider approach to the subject of algorithms and at the same time to indicate more clearly that the most general accessible notion for the contemporary state of the science of algorithms is completely connected in a natural manner with the notion of partially recurrent functions.

57. Sixth Degree Complex of Straight Lines

"A Sixth-Degree Complex of Straight Lines Generated by a Tetrahedral Complex," by V. A. Manevich, Moscow Aviation Institute imeni Sergo Orzhonikidze; Moscow, Doklady Akademii Nauk SSSR, Vol 122, No 2, Sep 58, pp 183-185

Construction of a sixth-degree complex of straight lines Σ^6, generated by a tetrahedral quadratic complex Σ^2 is considered and several properties of that complex are obtained.

58. Nonlinear Equations in a Banach Space

"Ramification of the Solutions of Nonlinear Equations in a Banach Space," by V. A. Trenogin; Moscow, Uspekhi Matematicheskikh Nauk, Vol 13, No 4 (82), Jul/Aug 58, pp 197-203

The equation

$$F(x, y) = 0, \tag{1}$$

where x, y, and F (x, y), respectively, belong to the Banach spaces E_1, E, and E is considered. Let the equation (1) have the solution $y = y_o$ for parameter $x = x_o$, ie,

$$F(x_o, y_o) = 0. \tag{2}$$

The finding of solutions of the equation (1) close to y_o, becoming y_o for $x = x_o$ is of great interest, otherwise, the continuation of the solution y_o according to the parameter x is of great interest. If the operator

$$\left[\frac{\partial F(x_o, y_o)}{\partial y}\right]^{-1}$$

exists and the function is continuously differentiable according to y in the Fresh sense in a certain neighborhood of the point (x_o, y_o), then the problem is worked out by theory of implicit functions. Serious difficulties arise if the existence conditions for

$$\left[\frac{\partial F(x_o, y_o)}{\partial y}\right]^{-1}$$

are violated. Such a problem is encountered in the theory of nonlinear integral equations. The condition that

$$\left[\frac{\partial F(x_0, y_0)}{\partial y}\right]^{-1}$$

exists is replaced by the condition that the Fredholm theorem holds for the operator $\frac{\partial F(x_0, y_0)}{\partial y}$.

Classical results were obtained in this region by A. M. Lyapunov ("Sur les figures d'equilibre peu differentes des ellipsoides d'une masse liquide homogene douee d'un mouvement de rotation, Premiere partie, Etude generale du probleme," Zap. AN (1906), 1-225) and E. Schmidt ("Zur theorie der linearen und nichtlinearen Integralgleichungen, III Teil," Math. Ann, 65 (1908), 370-399), which gave the theory of ramification for nonlinear integral equations, expanded in integral-power series. (See also R. G. Bartl, "Singular Points of Functional Equations," Tran. Amer. Math. Soc. 75, No 2, 1953; M. A. Krasnosel'skiy, Topologicheskiye metody, [Topological Methods], M., Gostekhizdat, 1956; and L. Lichtenstein, Vorlesungen ueber einige Klassen nichtlinearen Integralgleichungen und Integrodifferential gleichungen nebst Anwendungen, Berlin, 1931.)

59. Linear Functionals

"On the Representation of Linear Functionals in a Class of Discontinuous Functions," by A. N. Tikhonov and A. A. Samarskiy, Moscow, Doklady Akademii Nauk SSSR, Vol 122, No 2, Sep 58, pp 188-191

As is known, every linear functional A[f], defined in the class C_0 of discontinuous functions, given in the interval (a,b) is represented with the help of a Stieltjes integral

$$A[f] = \int_a^b f(x)\, d\alpha(x),$$

where $\alpha(x)$ is a function with a bounded variation (theorem of Ries). It is also known that this functional may be pursued on the class Q_0 of piecewise continuous functions. This continuation, however, is not single-valued.

The purpose of the above work is to give a representation for an arbitrary linear functional defined in Q_0.

60. Polyharmonic Functions

"Properties of Polyharmonic Functions," by Ya. S. Bugrov; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Matematicheskaya, Vol 22, No 4, Jul/Aug 58, 491-514

The differential properties of functions polyharmonic in a circle are clarified and shown dependent on the differential properties of the bounds of the functions.

61. Theory of Optimal Processes

"Theory of Optimal High-Speed Processes in Linear Systems," by R. V. Gamkrelidze, Mathematics Institute imeni V. A. Steklov, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Matematicheskaya, Vol 22, No 4, Jul/Aug 58, pp 449-474

Optimum processes in linear systems are studied. The existence of optimum processes in such systems is proved and equations for the optimum controls and trajectories are found. The problem of synthesis for such systems with one controlling parameter is considered.

62. Computation Stations To Be Established in Numerous Soviet Institutes

"On the Improvement of Mathematical Training of Engineers Graduating From Vuzes," by V. Yelyutin; Moscow, Byulleten' Ministerstva Vysshego Obrazovaniya SSSR, No 9, Sep 58, pp 7-9

Decree No 779, 24 July 1958, of the Ministry of Higher Education USSR directs that a plan be developed by 1 January 1959 for the organization and establishment of computation laboratories in all vtuzes (higher technical educational establishments) and universities of the USSR. The decree further directs that computation stations for the improvement of mathematical training be established in the following institutes: Moscow Power Engineering Institute, Moscow Higher Technical School imeni Bauman, Moscow Aviation Institute, Moscow Chemicotechnological Institute imeni Mendeleyev, Leningrad Polytechnic Institute imeni M. I. Kalinin, Leningrad Electrical Engineering Institute imeni V. I. Ul'yanov (Lenin), Leningrad Opticomechanical Institute, Leningrad Chemicotechnological Institute imeni Lensovet, Belorussian Polytechnic Institute, Azerbaydzhan Polytechnic Institute, Yerevan Polytechnic Institute, Odessa Polytechnic Institute, Ural Polytechnic Institute, Central Asian Polytechnic Institute, Georgian Polytechnic Institute, and Tomsk Polytechnic Institute.

VI. MEDICINE

Aviation Medicine

63. G-Stresses on Man in Flight

"Man in Flight and Overload Factors," by Lt Col Med Serv V. Usachev, Candidate of Medical Sciences; Moscow, Sovetskaya Aviatsiya, 22 Aug 58, p 3

(This article was written in reply to the question of Engr-Lt Sh. Bayshev: "What are the possible maximum gravitational stress limits on an aviator in flight?")

"An increase in the speed or a change in the direction of an airplane is called acceleration. Negative accelerations, in which the force acting on the body of the occupant of an airplane is from foot to head, are particularly unfavorable. Such accelerations take place, for example, when a 'reverse loop' is executed. When this is executed the flow of blood to the head increases; this leads to hyperemia of vessels of the brain and the retina of the eyes. Results of research showed that a force of 3 Gs, acting in the direction of foot to head, creates disturbance in vision within 5-6 seconds.

"Scientists have been studying this type of acceleration and its effect on the human organism for many years. However, nothing has been published until now concerning the possibility of increasing human tolerance by means of conditioning. Little can be done about it if we do not consider the 'prone' position in which tolerance to acceleration is enhanced.

"Accelerations in which G forces act in the direction of head to foot are encountered most frequently. These accelerations produce varied physiological changes in the organism depending mainly on the effects of centrifugal forces on the cardiovascular system. Results of experiments conducted with the aid of centrifuges show that vision becomes poor.

"When acceleration of 4 Gs lasts 3-5 seconds, contraction in peripheral vision usually results, and after 1-2 seconds, only central vision remains unimpaired. Acceleration of 5 Gs lasting 5-6 seconds causes the central vision to become hazy and then disappear altogether. This symptom usually precedes loss of consciousness, and for that reason, the aviator piloting a plane at a great rate of speed thereby receives a momentary signal of approaching loss of consciousness.

"Consequently, acceleration of 5 Gs, lasting 10-20 seconds, is the limit of tolerance for the majority of healthy people who have not been put through a period of conditioning.

"On the other hand, the human organism is capable of enduring gravitational force of great magnitude for a brief period of time. For example, when a man is catapulted from his plane there follows a brief period (lasting 0.1-0.15 second) of acceleration of 18-20 Gs which is well tolerated. This brief period of exposure to G force of great magnitude results in no ill effects.

"However, if execution of acrobatic maneuvers or catapulting preceded a protracted flight (within 5-6 hours), the organism will be more sensitive to G forces. The danger of emergence of significant G forces decreases at high altitude, because the thinness of the atmosphere excludes violent maneuvering. Acceleration therefore will not exceed 2.5-3 Gs.

"The extent of functional resistance to centripetal accelerations can be changed, depending on an individual's physical condition. Any breach in the preflight regimen, fatigue, use of alcohol, smoking, lack of physical training, and various illnesses can reduce a flyer's resistance to G forces.

"Systematic flight training, pursuit of sports, proper diet and sleep regimen, training on a centrifuge, and the use of the anti-G suit can contribute to better tolerance of G forces. Flyers who have gone through a period of training are able to endure acceleration of 6-7 Gs for many seconds without any impairment to their efficiency.

"Tolerance of gravitational stress can be increased by assuming an inclined position. However, such a posture has not been used very much, because it reduces visibility and is not a very convenient position for steering. The effective way to increase tolerance to centripetal accelerations is the anti-G suit. Its use while in flight increases tolerance to G forces by about 2 Gs. This permits flyers to make full use of the maneuverable capacities of modern fighter planes.

"Thus, in answer to the direct question concerning the limits of human functional tolerance of gravitational forces, it is possible to offer a rough estimate, especially if in addition we take into consideration the wide range of individual resistance. It is important to remember that the main symptoms which must alert the airplane pilot are visual disturbances: they serve to warn the flyer that acceleration must be reduced."

64. The Psychology of Instrument Flying

"A Few Questions on the Psychology of Instrument Flying," by Lt Col Med Serv B. Yakubov and Maj Med Serv Yu. Petrov, Candidate of Medical Sciences; Moscow, Sovetskaya Aviatsiya, 5 Sep 58

"Flying demands of every member of an aircrew precise coordinated movements, constant attentiveness, and a good and well-trained memory. Possession of such qualities assures flight safety under complicated meteorological conditions.

"The guidance and navigational equipment found on all modern airplanes provides an aviator with the necessary information which makes up for lack of opportunity to observe natural horizon and landmarks directly.

"It can be seen, therefore, how decisive is the role of indicators on the guidance and navigational instruments. Successful execution of flights in clouds and overcoming complications involved in spatial orientation are afforded to a very great extent by an aviator's ability to think; the authentic perception of space in flight by means of instruments is not only a complicated neuropsychic process, but also a clear index of emotional saturation of activity.

"Consider for example the flight of Military Flyer First Class Zakharov. He executed a flight course under complicated meteorological conditions at an altitude of 3,000 meters. On his return to the airport, the fighter plane entered a region of intensive storm. Experiencing complications involving spatial orientation, the flyer decided to maintain continuous radio contact with the flight officer.

"The flight officer calmly and confidently informed the flyer what the meteorological conditions were in the area of the airport offered advice on how to pierce the clouds underneath, and told him to contact the control radio station, specifying the position of the airplane. All this helped the aviator to carry out his flight mission successfully, to emerge exactly in the area of the airport, and to bring the airplane in under extremely complicated meteorological conditions.

"When some flyers find themselves in a difficult situation, they consider it 'awkward' to communicate with someone on the ground or to ask the flight officer for advice. Besides, communication by radio with a flight officer is very helpful to a flyer at high altitude, particularly when piercing the clouds underneath and attempting to make a landing at a time when visibility is limited.

"Agitation, worry, and at times a state of confusion hinder a flyer's movements or may lead to wrong decisions. For that reason, a flyer may briefly lose his ability to evaluate his actions while aloft in guiding his plane to its destination.

"There are actually cases when flyers do not react in time to deviations from a given flight schedule. When this happens the flyer may show symptoms of varied illusory perceptions of the spatial position of the plane.

"It must be considered that situations such as convective currents, varying density of the air, temperature fluctuations, and other natural phenomena always exist in the atmosphere and are encountered by planes in flight. These phenomena produce extensive changes in the physiological activity of the organs of sensation, particularly in the organ of vision, the vestibular apparatus, and the muscular system.

"The airplane of pilot Nikolayev was in an inverted position while flying through clouds. For a while the pilot was unable to evaluate the spatial position of his plane. This happened because he disregarded the readings of instruments in his airplane and depended entirely on his own 'flight perception.'

"Varied density and illumination of clouds, their uneven distribution at different altitudes, and the presence of gaps in the clouds distracted Nikolayev. The pilot chose this imaginary 'support' in preference to information appearing on the artificial horizon and other flight navigation instruments.

"Among many factors that contribute to the advent of illusions in flyers are pre-existent diseases which occurred in the not-too-distant past. It happened in one of the flight units: pilot N, who had recently recovered from a bad cold at which time he had had a high temperature, was allowed to take part in night flying exercises under complicated meteorological conditions. The pilot was not in good enough physical condition to be able to perform complicated tasks. However, the flight officer in charge and the unit physician did not seem to be high-principled enough and 'felt timid' about refusing a comrade who was senior to them in rank and position. Finding himself within a solid mass of clouds, pilot N temporarily lost all spatial orientation: he made awkward errors and was able to land only because of his extensive experience.

"This case should attract the attention of commanding officers and aviation medical officers. Flyers who have not completely recovered from illness should not be permitted to fly. Health and individual peculiarities of each flyer must be taken into consideration.

"Flight officers in command are obliged to see that their flight personnel are well trained in handling the guidance and navigation systems in their planes. In ordinary flights in which visual orientation is sufficient, the flyers must watch the instrument readings carefully during various maneuvers: gaining altitude, descent, horizontal turning maneuver, and spirals. This will pay valuable dividends to flyers when they are forced to guide their planes through a solid mass of clouds and will permit them to orient themselves rapidly and freely while flying through space.

"It is quite useful to have a flyer being tested in a training plane make a running report of the position of the airplane while it is going through various maneuvers (with the second cabin covered at the time by a curtain).

"Publicizing the experiences that a flyer may have while aloft can contribute much toward increasing the efficiency of those who have already mastered flying by instruments. It is necessary to take into consideration that every experienced flyer acquired his skill the hard way -- by doing. Arrangements must be made to have unit flying technique and theoretical-practical conferences at which the best flyers of the unit may share their experiences.

"Aviation medical officers, together with commanding flight officers, must make provisions for safety while in flight, must tell their flight personnel about the established psychological and physiological mechanisms of spatial orientation, point out the great significance of a rational regimen of rest and nutrition, and recommend continual training of self-control, dynamic attentiveness, and memory. An atmosphere of calmness must exist during take-off. It is necessary to avoid abrupt relationships with flyers. It must be kept in mind that emotional overexertion and nervousness among flyers may result in accidents while in the air.

"In conclusion, it should be stated that in an effort to improve the quality of combat training it is necessary to observe in a strict manner the aptitude, interests, and shortcomings of each aviator. In connection with this, it is necessary to observe constantly the individual psychological peculiarities of each soldier and to supply concrete and intimately personal guidance dealing with the entire process of combat and political training of flight personnel."

65. Soviet Oxygen Breathing Equipment Mentioned in Czechoslovak Press

"High Altitude Flights and Oxygen," by Jan Hospodar, MD, Prague, Kridla Vlasti, 30 Sep 58, pp 16-18

This article describes and illustrates various oxygen breathing equipment and pressure suits. The majority of the equipment appears to be American. Two specific references to Soviet equipment, however, are made.

The article states that the Soviet high-altitude oxygen mask "KP-14" is currently used for flights up to 10,000 meters and may be used for short periods of time up to 12,000 meters.

The article also states that the more modern oxygen masks, such as the Soviet "KP-18," are better. These prevent the sucking in of "false air" (thin air) which causes altitude sickness by building up pressure within the mask. With these masks a pilot may fly with safety at 12,000 meters.

66. 30-Year Study Confirms Advantages of Transfusing Cadaver Blood Into Living Organisms

"The Origin of the Idea of Transfusing Blood From Cadavers, and the Future Prospects of Using Fibrinolyzed Blood," by V. N. Shamov; Moscow, Eksperimental'naya Khirurgiya, No 5, Sep/Oct 58, pp 8-14

The author reviews the history of the idea of using cadaver blood for transfusion into living organisms. This includes bacteriological studies of the tissues and organs after various periods of death, the development of "cadaver toxins," and the duration of the viability of cadaver blood.

The author refers to a report presented by him at the Third Ukranian Convention of Surgeons in 1928. In this report he established through his research the advantages of transfusing cadaver blood taken 6-10 hours after death. His continuous research in this field confirm the following:

1. Cadaver blood retains its full value for about 10 hours after death and may be used with the same success as blood taken from live donors.

2. Strict aseptic rules must be followed in taking blood from a cadaver to prevent the transfer of any diseases, toxins, or infectious agents to the recipients.

3. Cadaver blood has the advantage of not requiring anticoagulants to preserve it.

4. The morphological and biochemical composition of preserved cadaver blood differs very little from preserved donor blood, except that in people who die suddenly the sugar content is 5-6 times as high as the normal level.

5. The fact that up to 4 liters of blood may be drawn from one cadaver, which is equivalent to blood drawn from 5-8 live donors, is significant in those cases requiring massive and repeated transfusions.

6. Cadaver blood is easier and safer to collect than donor blood.

The chief argument against using cadaver blood is labeling it as "cadaver blood." To solve this, the author suggests that such blood be labeled as "Blood B," or "Fibrinolyzed Blood."

67. Ultrahigh-Frequency Electric Fields Increase Activity of Hemostatic Blood Preparations

"Changes in the Activity of Hemostatic Blood Preparations Under the Effect of Ultrahigh-Frequency Electric Field," by V. P. Shtol'tser, Leningrad Institute of Blood Transfucion (director, Docent A. D. Belyakov; and scientific director, Prof A. N. Filatov, Corresponding Member, Academy of Medical Sciences USSR); Moscow, Problemy Gematologii i Perelivanii Krovi, Vol 3, No 3, May/Jun 58, pp 38-42

At present, a number of biological preparations derived from blood are used for hemostatic purposes, for example, a hemostatic sponge, biological tampon, and fibrin powder. The Leningrad Institute for Blood Transfusion conducted tests to increase the activity of these hemostatic substances by exposing them to ultrahigh-frequency electric current. Experimental details are presented. Tables illustrate changes in the activity of hemostatic preparations under the effect of ultrahigh-frequency electric current, both in vitro and in vivo experiments.

Results indicate the following:

"1. The activity of hemostatic preparations made from blood (hemostatic sponge, biological tampon, and fibrin powder), after being exposed to an ultrahigh-frequency electric field, is increased both in vitro and also in stopping hemorrhage in the paryncnymatous organs of dogs. This increased activity is retained for about 3 months.

"2. The increased activity of the preparations is not dependent on temperature and on changes in residual humidity after the preparations have been treated by ultrahigh-frequency electric field.

"3. The increase in the activity of the preparations after their exposure to ultrahigh-frequency electric field depends chiefly on the activation of thromboplastin extract of the brain, occurring in the composition of the hemostatic preparations."

The author concludes as a result of these preliminary tests that the mechanism for the activation of these preparations in an ultrahigh-frequency electric field is linked with the hydrolysis of thromboplastin extract of the brain by water.

68. Blood Processing Extends Usefulness From 7 to 30 Days

"A Study of Certain Biochemical and Physiochemical Changes in the Blood Prepared Without Stabilizers During the Process of Its Preservation," by Ye. V. Antonova and L. S. Rotfel'd, Leningrad Institute of Blood Transfusion (director, Docent A. D. Belyakov; scientific director, Prof A. N. Filatov, Corresponding Member, Academy of Medical Sciences USSR); Moscow, Problemy Gematologii i Perelivaniya Krovi, Vol 3, No 3, May/-Jun 58, pp 43-48

The aim of this research was to study certain biochemical, physiochemical, and morphological changes in blood treated by ion exchange resin during its processing for storage.

Results indicate the following:

"1. The calcium content is decreased by half and the sodium content rises when the blood is treated by a cation exchange resin. There are no changes in the content of potassium, phosphorus, glucose, and lactic acid; the minimum osmotic resistance of erythrocytes; or free hemoglobin in the plasma. Blood alkalinity is slightly increased (pH 8.4).

"2. Changes arise significantly sooner in cationic blood than in citrated preserved blood. The biological efficacy of cationic blood is not changed after being preserved at 4-5° C for 7 to 8 days. Blood preserved without stabilizers retains its blood coagulation components well.

"3. The addition of glucose-saccharose solution together with synthomycin significantly prolongs the period of preservation for cationic blood, and a 1:1 dilution with the above-mentioned solution prolongs the period of storage to 28-30 days."

69. Skeletal Muscles Proved Chief Site for Pooling of Blood During Shock

"On the Distribution of Blood During Traumatic Shock," by R. M. Mel'nikov, Tr. Vses. Konferentsii po Med. Radiol. Eksperim. Med. Radiol., Moscow, Medgiz, 1957, 270-272; (from, Referativnyy Zhurnal--Biologiya, No 10, 25 May 58, p 434)

"Erythrocytes tagged with radioactive phosphorus were administered intravenously to rabbits, and in 20-30 minutes shock was produced by pulling on a mesentery. The animals were sacrificed during the fourth stage of shock. The activity of the liver and kidney tissue was unchanged. The activity of the spleenic tissue consisted of 0.2% of the administered dose of P^{32} per gram of tissue as compared with 0.32% in the controls; the

activity of skeletal muscles was 0.025% against 0.007% in the controls, and the activity of brain tissue was 0.009% against 0.016% in the controls. Considering that tissue activity is determined by the degree of hyperemia of an organ, it is possible to assume that during shock in rabbits, blood is pooled chiefly in the skeletal muscles."

70. Blood Platelets Elaboration Proved a Normal Physiological Process of Megakaryocytes

"Magekaryocytes in Tissue Cultures and Their Role in Blood Platelet Production," by A. M. Yeroshkina, Institute of Experimental Pathology and Cancer Therapy (director, Prof N. N. Blokhin, Corresponding Member, Academy of Medical Sciences USSR), Academy of Medical Sciences USSR; Moscow, Problemy Gematologii i Perelivaniya Krovi, Vol 3, No 5, Sep/Oct 58, pp 21-25

The author made in vitro studies of megakaryocytes from the bone marrow of white rats, rabbits, cats, etc. in an effort to investigate the various theories connected with the origin of blood platelets from megakaryocytes. Photomicrographs illustrate the process in tissue cultures of megakaryocytes of rats after a 2-hour period, 10-hour period, and megakaryocytes of cats showing mass production of blood platelets. Another series of four photomicrographs shows the process of blood platelet production in rat megakaryocytes.

The author concludes that the process of elaborating blood platelets from megakaryocytes is a normal physiological process of megakaryocytes, and does not result in the degeneration or death of the cells. It follows from this that blood platelets are not the products of degeneration or decomposition of the megakaryocytes, but particles of the body of these cells which are capable of surviving for a certain period of time.

71. Antibiotic Therapy of Brucellosis

"Levomycetin Therapy of Experimental Brucellosis," by V. S. Uralyeva, Tr. Rostovsk.-na-Donu Gos. N.-I. Protivochumn. In-ta (Works of the Rostov-na-Donu State Scientific Research Antiplague Institute), No 11, 1956, pp 27-37 (from Referativnyy Zhurnal--Biologiya, No 9, 10 May 58, Abstract No 42480, by O. A. Chaykina)

"Experiments were performed on 425 guinea pigs. The animals were infected subcutaneously with virulent strains of Brucella melitensis in a dose of 500 microbial cells. Therapy of the pigs was begun at different periods after infection and was carried out for 5-30 days. Levomycetin was introduced perorally every 6-8 or 12 hours in a daily dose of 60 mg. It was demonstrated that upon prolonged therapy (at least 20 days) levomycetin has a positive effect on the course of brucellosis in pigs. This is manifested by a decrease in the number of culturable Brucella and a transition of generalized infection into localized. Complete elimination of Brucella from the animal organisms rarely occurred. Combined therapy with levomycetin and vaccine administered simultaneously or in short alternate courses afforded the same results as therapy with the antibiotic alone; however, the long-term results of combined therapy were more effective. The introduction of levomycetin into pigs infected with Brucella had no effect on the development of immunity to super- and reinfection. Treatment of humans suffering from brucellosis with levomycetin and synthomycin led to cessation of bacteremia in a significant number of cases. Hemocultures of Brucella isolated after therapy were often found to be weakly virulent and radically altered with respect to other characteristics."

72. The Mechanism of Synthomycin and Levomycin in Brucellosis

"The Problem Concerning the Mechanism of the Therapeutic Action of Synthomycin and Levomycin in Brucellosis," by G. A. Balandin and N. P. Prostetova, Tr. Rostovsk.-n.-D. N.-I. Protivochumn. In-ta (Works of the Rostov-na-Donu Scientific Research Antiplague Institute), No 10, 1956, pp 384-391; (from Referativnyy Zhurnal -- Biologiya, No 8, 28 Apr 58, Abstract No 37680, by L. A. Strugach)

"Information in the literature indicates that during the treatment of brucellosis patients with synthomycin and levomycin the symptoms of the disease are quickly dissipated; however, neither preparation has an etiotropic action. The administration of synthomycin and levomycin does not

impede the generalization of the infection in mice affected by brucellosis. It is believed that the therapeutic action of synthomycin and levomycin against brucellosis is dependent on the development of areactivity of the macroorganism. A relapse is dependent on the restoration of the reactivity of the patient infected by the brucellosis organism after the administration of these antibiotics has been stopped."

73. Effect of X-Ray Irradiation on Immunity To Paratyphoid in Monkeys

"Concerning the Question of the Effect of General Roentgen Irradiation on the Course of Paratyphoid B in Monkeys," by L. A. Yakovleva, B. A. Lapin, S. M. Pekerman, and M. I. Novikova, Trudy Vsesoyuznoy Konferentsii po Meditsinskoy Radiologii (Works of the All-Union Conference on Medical Radiology), 1957, pp 185-187; (from Meditsinskiy Referativnyy Zhurnal, Supplement, Section 4, 1958, p 75)

"Experiments were conducted on 34 one-year-old monkeys (young macaque rhesus and Chinese macaques) infected by a standard strain of paratyphoid B. Observations showed that the sufficiently stable immunity which was produced by undergoing paratyphoid was not disturbed by irradiation with a 250 r dose, but in a number of cases was disturbed after irradiation by a 400 r dose. The dynamics of the elaboration of antibodies, when a correlation is made between the development of paratyphoid infection and the radiation process, do not sufficiently characterize a state of immunity."

74. Use of the Biological Antiseptic Tampon as a Hemostatic and To Prolong Local Penicillin Effect

"Biological Antiseptic Tampon- A Blood Preparation Ensures Long Penicillin Effect," by N. M. Aleksandrova, Laboratory of Dry Preparations From Blood (leader, Prof L. G. Bogomolova), Leningrad Scientific Research Institute of Blood Transfusion (director, Docent A. D. Belyakov; and scientific leader, Prof A. N. Filatov, Corresponding Member, Academy of Medical Sciences USSR); Moscow, Problemy Gematologii i Perelivaniya Krovi, Vol 3, No 3, May/Jun 58, pp 48-52

In an effort to discover substances that would prolong penicillin effect, it was determined that blood, due to its therapeutic effect, when introduced intramuscularly or subcutaneously prolonged the effect of antibiotics administered with it. A new preparation made from blood, the biological antiseptic tampon, was developed and tested to determine its capacity for prolonging the effect of penicillin.

Details on amounts of penicillin and duration of effectiveness of the tampon are presented.

The author concludes that blood and blood preparations (erythrocyte mass, various serums, etc.) can be successfully used to prolong penicillin effect. The administration of penicillin with blood and blood preparations effects an additional nonspecific therapeutic effect by increasing the defensive power of the patient. The new preparation, the biological antiseptic tampon, in addition to its hemostatic properties, ensures a long period of therapeutic concentration of the antibiotic both in the wound and in the blood of the patient.

75. Use of Tetraethylmonothiopyrophosphate in Experimental Therapy

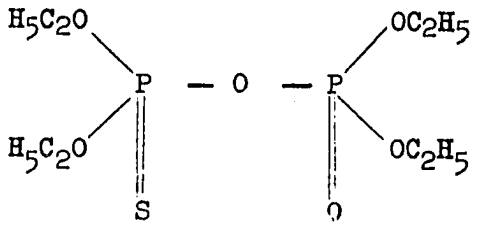
"The Treatment of Experimental Paralysis With Tetraethylmonothiopyrophosphate," by M. M. Lenkevich, Khimiya i Primyeneniye Fosfororgan Sovedinenij (The Chemistry and Utilization of Organophosphorus Compounds); Moscow, Academy of Sciences USSR, 1957, pp 344-353, discussion, pp 353-355 (from Referativnyy Zhurnal --- Biologiya, No 8, 28 Apr 58, Abstract No 37539, by R. Yu. Il'yuchenok)

"The therapeutic action of tetraethylmonothiopyrophosphate was investigated in peripheral and central paralysis in mice. In peripheral paralysis, obtained as a result of traumatic injury to the sciatic nerve, recovery after the subcutaneous administration of a dose of 0.06 mg/kg of the phosphate began 2.3 times faster than the recovery of the controls. Increasing the dosage to 0.18 mg/kg together with earlier administration results in a swifter therapeutic effect. The prophylactic administration of 0.18 mg/kg also reduces the recovery time. With intra-abdominal administration, the rate of the onset of the therapeutic effect, in comparison with subcutaneous administration, is relatively unchanged. With central paralysis having a neurovirological etiology, the administration of the phosphate as a prophylactic or after the injury produces a marked therapeutic effect. The degree of protection offered is not the same against various viruses. Apparently the protective action of the phosphate is dependent on inhibition of the true cholinesterase which forms in excessive quantities in the central nervous system due to the action of the neuro-virus, which obstructs the manifest action of acetylcholine. The prospects for utilizing this phosphate against polio were mentioned."

76. Organophosphorus Compounds and Their Effects

"The Effect of Organophosphorus Compounds on Salivary and Intestinal Secretion," by T. Yu. Il'yuchenok, Khimiya i Primenyeniye Fosfororgan. Soyedineniy (The Chemistry and Application of Organophosphorus Compounds), Moscow, Academy of Sciences USSR, 1957, pp 318-322, discussion, p 323; (from Referativnyy Zhurnal--Biologiya, No 8, 25 Apr 58, Abstract No 37536, by R. Yu. Il'yuchenok)

"The quantity and solid residue of saliva was determined in dogs with drain tubes in the parotid and submaxillary glands after they had been fed 2 g of powdered sugar. The cholinesterase activity was determined by the Borisov-Rozengart method. Intestinal secretion was determined by the Tiri-Vell method after the dogs' intestinal wall had been subjected to mechanical irritation and a calomel test. The preparations were administered subcutaneously in doses of 1-10% of a LD_{100}. All the organophosphorus compounds investigated, after single administration of small doses, intensify salivary secretion for a long period of time. The increase in salivary gland reactivity persists for 3-9 days, and for three of the compounds, 30 days. The single administration of preparation No 14,



in a dose of 0.0135 mg/kg increases the secretion of the intestinal glands within 72-144 hours for 15 days. The amylase content in the gastric juice was unchanged after the administration of preparations No 14 and 75."

77. Anticholinesterase Substances and Their Effect on Higher Nervous Activity

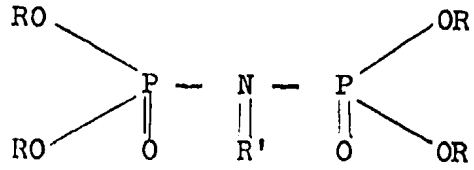
"The Effect of Anticholinesterase (Organophosphorus and Others), Cholinomimetic, and Cholinolytic Substances on the Higher Nervous Activity of Humans and Animals," by M. Ya. Mikhel'son, N. V. Savateyev, N. Ye. Lukomskaya, Ye. K. Rozhkova, and L. M. Grigor'yeva, Khimiya i Primeneniye Fosfororgan Soyedinenniy, (The Chemistry and Application of Organophosphorus Compounds); Moscow Academy of Sciences USSR, 1957, pp 324-334, discussion, pp 334-335; (from Referativnyy Zhurnal--Biologiya, No 10, 25 May 58, Abstract No 47190, by R. Yu. Il'yuchenok)

"The subcutaneous administration of 3-4 mg/kg of pentaphene to healthy humans produces expressed disruption in higher nervous activity after 2-3 hours, while with the administration of 5 and 10 mg/kg consciousness is completely disrupted in 2-5 hours. With the simultaneous administration of pentaphene (3.0-3.5 mg/kg) with proserin (0.02 mg/kg), disruption in psychic activity is sharply decreased. The administration of atropine (0.17 kg/mg) to dogs produced a disruption in conditioned reflex activity; simultaneous administration of proserin (0.03 mg/kg) decreased and sometimes completely eliminated these effects. In experiments on dogs and rats, it was determined that proserin (0.01-0.05 mg/kg) and phosphacol (0.02-0.03 mg/kg) prevent or decrease the disruption of the central nervous system which was caused by atropine (1.25-10.0 mg/kg), scopolamine (1.25-5.0 mg/kg), gangleron (10 mg/kg), pentaphene (20 mg/kg), arpenal (20 mg/kg), and diphazine (10 mg/kg). Antagonism in the action of corresponding doses of cholinolytic and anticholinesterase substances was noted, particularly while studying their effect on the processes of active, internal inhibition: cholinolytics had a decreased effect while anticholinesterases increased their activity."

78. Chemical Structure and Anticholinesterase Activity

"The Dependence of Toxicity and Anticholinesterase Activity on the Chemical Structure of a Series of Alkyl-amides of Didialkylphosphoric Acids," by I. A. Frankov, Khimiya i Primeneniye Fosfororgan. Coyedineniy (The Chemistry and Application of Organophosphorus Compounds), Moscow, Academy of Sciences USSR, 1957, pp 366-371; discussion, p 371 (from Referativnyy Zhurnal--Biologiya, No 18, 25 Apr 58, Abstract No 37535, by R. Yu. Il'yuchenko)

"The toxicity to mice after subcutaneous administration and the anticholinesterase properties (in experimental tests conducted according to the Borisov-Rozengart method) of the following type of organophosphorus compounds were investigated:



where R are alkyl radicals and R' a methyl or ethyl group. The toxicity and anticholinesterase properties of the compounds in the series of alkylamides of di-dialkylphophoric acid are dependent on the structure of the alkyl radicals connected to the phosphorus and nitrogen. Substituting propyl radicals, connected to the phosphorus, for isopropyl radicals in the series of monoethylamides reduces the toxicity by a factor of 56.3; there is also a marked lowering of anticholinesterase properties (78.9% blockage with a 1:1,000 dilution as opposed to 100% blockage with a 1:1,000 dilution). In the monoethylamide series, substituting the unbranched chains for isopropyl groups in the radicals connected to the phosphorus, or increasing the number of carbon atoms lowers toxicity; however, it has little effect on the anticholinesterase properties. A decrease in toxicity and anticholinesterase properties is accomplished by increasing the number of carbon atoms in the radicals connected with the nitrogen in the compounds where the radicals connected to the phosphorus have unbranched chains. In cases where iso-groupings are present, there is an increase in toxicity and anticholinesterase properties."

79. Properties of Thiophosphoric Compounds

"The Pharmacological and Toxicological Properties of Thiophosphoric Compounds," by A. V. Reut, Khimiya i Primyeneniye Fosfororgan. Soyedineniy (The Chemistry and Application of Organophosphorus Compounds); Moscow, Academy of Science USSR, 1957, pp 313-317, discussion, p 317; (from Referativnyy Zhurnal --Biologiya, No 8, 28 Apr 58, Abstract No 37537, by R Yu. Il'yuchenok)

"Eight alkyls and alkyl amides of thiophosphoric acid were investigated. After subcutaneous administration to mice, the 'DMT,' LD_{50} and LD_{100} can be expressed for the majority of the compounds in thousandths of ml/kg. Their toxicity is lowered 2.4-3.8 times when administered intra-abdominally. Intoxication in mice is accompanied by an increase in respiration, convulsive twitching of the extremities and the entire body, copious salivation, and finally death resulting from respiratory failure. In acute experiments on dogs, some increase in blood pressure was noted followed by a disruption of cardiac activity and a decrease in respiration. The administration of atropine (0.5 mg/kg) increases the resistance of the dogs by 4-10 times. An EKG discloses that toxic doses of thiophosphoric compounds produces a decrease in the activity of the sinal node and disrupts conductivity and excitability in the auricles and and ventricles with a consequent transition to an arterioventricular block. Strong myotic and hypotensive action on the eyes was noted with all the preparations investigated."

80. Atropine and Its Effects on the Cardiovascular System

"The Effect of Atropine on the Cardiovacular System of Horses," by V. S. Dolgov and V. I. Tarakanov. Nauchn. Rabot Stud. Mosk. Vet. Akad (Scientific Works of the Students of the Moscow Veterinary Academy), No 3, 1956, pp 22-31 (from Referativnyy Zhurnal--Biologiya, No 8, 28 Apr 58, Abstract No 37558, by F. G. Sivashinskaya)

"The experiments were conducted on horses. A 1% solution of atropine sulfate in doses of 0.5-10 ml was administered subcutaneously. With the administration of 0.5 ml, maximum blood pressure increased by 7-17 mm (Hg), and the minimum by 5-7 mm (Hg), the P-Q section of the EKG was decreased by 0.05 sec, the QR increased by 0.03 sec and the pulse rate increased from 32 to 40 beats. With the administration of one ml the maximum blood pressure increased by 8-12 mm (Hg), the minimum decreased by 9-17 mm (Hg), the PQ section of the EKG decreased by 0.08 sec, the QR by 0.02 sec, and the pulse rate was unchanged. With the administration of 3 ml, the maximum blood pressure increased by 13-31 mm (Hg), the minimal, by 20-50 mm (Hg), the P-Q of the EKG increased by 0.18 sec; the RS, by 0.12 sec, and the pulse rate increased from 30 to 73 beats. It was noted that the action of atropine sulfate was more expressed in animals with a predominance of the sympathetic nervous system."

81. Phytoncidal Properties of 56 Medicinal Plants

"The Phytoncidal Properties of Certain Medicinal Plants Among Flora of Stavropol," by M. L. Parfenova, Uch. Zap. Stavropol'sk. Med. In-t. (Scientific Notes of the Stavropol Medical Institute), No 1, 1957, pp 61-75 (from Referativnyy Zhurnal--Biologiya, No 8, 28 Apr 58, Abstract No 34837, by T. L. Braytseva)

"The phytoncidal properties of 56 species of medicinal plants, growing in the Northern Caucasus, were investigated. The leaves, flowers, seeds, bark, and roots of the plants were investigated both in the fresh and dry state, and after a year of storage. The effect of the volatile and liquid fractions of the phytoncides on Paramecium caudatum, E. coli, typhoid bacillus, dysentery bacillus, and Staphylococcus albus and aureus was investigated. All of the 56 species investigated possessed phytoncidal properties. Different parts of the plants do not possess the same quantities of phytoncides. A greater portion is contained in the leaves and seeds; however, some plants contain a greater portion in the roots and seeds. The morphological changes in the paramecium were not identical, depending on the type of phytoncide being investigated. Some of the plants investigated retained their phytoncidal properties even after being stored for a year. The following plants possessed the greatest phytoncidal action: Peganum harmala, the bark and fruit of Viburnum opulus, the roots of Valeriana, the tricolor Viola, Hypericum, and Erythrea cantaurium in the preserved and dry state."

82. Pharmacological Activity of Hyssopus angustifolius

"The Pharmacological Properties of the Total Alkaloids of Hyssopus angustifolius," by G. L. Vepkhvadze, Tbilissk. n.-i. Khim.-Fermatsevt. in-ta. (Tbilisi Scientific Research Chemical Pharmaceutical Institute), 1956, pp 101-111 (from Referativnyy Zhurnal--Biologiya, No 11, 10 Jun 58, Abstract No 51966, by V. V. Berezhinskaya)

"In experiments on frogs, dogs, rabbits, and cats, the action of the total alkaloids of the Hyssopus angustifolius was studied in comparison with atropine. It was determined that Hyssopus angustifolius possesses cholinolytic properties: removes the effects of the vagus nerve on the heart, has an inhibitory effect on the secretion of saliva, dilates the pupils, depresses the peristaltic movement of an isolated section of the intestines, relaxes the smooth musculature of the bronchi. It possesses markedly lower biological activity than atropine."

83. Pharmacological Properties of the Alakaloid From Vinca herbacea

"The Pharmacological Properties of the Alakaloid From Vinca herbacea," by Ts. P. Tkabladze, Tbilissk. n.-i. Khim.-Farmatsev. in-ta., (Tbilisi Scientific Research Chemical Pharmaceutical Institute), 1956, pp 91-100 (from Referativnyy Zhurnal-Biologiya, No 11, 10 Jun 58, Abstract No 51967, by V. V. Berezhinskaya)

"The pharmacological properties of the alkaloid sulfate of Vinca herbacea were investigated on frogs, rabbits, and dogs in comparison with atropine. With subcutaneous administration and administration of predetermined quantities, through the superior vena cava to frogs subjected to lumbar pithing, the alkaloid completely eliminated the effect of the vagus nerve on the heart. In addition, it disrupts the rhythm of the heart, dilates the pupils, and reduces the secretion of saliva produced by pilocarpine. Therefore, the specific pharmacological action of the alkaloid is similar to atropine; however, it is markedly weaker. Hypotensive action was also detected."

84. Prophylaxis and Treatment of Motion Sickness

"Pharmacological Prophylaxis and Therapy of Motion Sickness," by R. A. Okunev, Klinicheskaya Meditsina, No 9, Sep 58, pp 72-76

The author describes the results of experiments conducted to test the effectiveness of newer drugs used to prevent and treat motion sickness. The drugs that proved most effective were pentaphene hydrochloride, diphasin hydrochloride, and aminazine. Diphasin proved effective in preventing motion sickness in 81% of the people tested; aminazine, in 74%; and pentaphene, in 73%. Diphasin proved effective in treating motion sickness in 61% of the people experimented with; aminazine, in 54%; and pentaphene, in 48%. In contrast to pentaphene and aminazine, diphasin caused practically no secondary effects: only 15%-20% of people experimented with experienced secondary effects consisting of vertigo and a mild form of somnolence. These secondary effects passed away within 20-40 minutes and they did not in any way affect the efficiency of people under observation. This confirms the conclusions reached by A. I. Vozhzhkova (1948) that pentaphene, diphasin, and aminazine are 1.5-2.0 times more effective in preventing motion sickness than in curing it.

Effectiveness and duration of action of preparations experimented with depended on many factors: the level of vestibulo-vegetative sensitiveness of persons experimented with, seagoing experience, the swell of the sea, character and duration of the ship's tossing, manifestation of any kind of symptoms of motion sickness, etc. On an average, when used to prevent motion sickness, the duration of effect of the above-mentioned drugs was 6-12 hours; when they were used to treat motion sickness, the duration of their effect was 4-8 hours. It was evident that diphasin produced excellent to good results in 89% of persons exposed to mild motion sickness (first degree motion sickness). But in persons exposed to third degree motion sickness, diphasin was half as effective: good to excellent results were observed in 48% of persons experimented with. It must be noted that condition of the sea, on which the force of ship's tossing depends, plays an important part in producing motion sickness in the people aboard.

Besides diphasin, medinal and a mixture of Syabo (platyphylline, bromine, caffeine) can also be recommended for prevention and treatment of motion sickness.

Although a combination of pentaphene and aminazine with dimedrol and caffeine produced adequate effect in 63%-72% of the people experimented with, their use by naval personnel cannot be recommended because they caused a secondary effect which consisted of drop in efficiency in 34%-42% of the people. Nonetheless these preparations can be administered to airplane passengers and passengers aboard ships. Anesthesin, aero (vasano), dimedrol, and urotropin did not prove very effective.

A total of 1,635 experiments were conducted with 675 people. Since it was difficult to observe the natural rolling of a ship and the effect of this rolling on the human organism and since the percentage of cases of motion sickness during natural (at sea) conditions and artificial (turning in Barany chair) conditions was found to be the same (76.8), the Barany chair was used during the early stages of investigation. All experiments were conducted with the aid of the vestibulometric method of Voyachek.

85. New Method of Local Pupillography Aids in Diagnosing Diseases of the Central Nervous System

"Local Pupillography" (unsigned article); Moscow, Meditsinskiy Rabotnik, No 83, 17 Oct 58, p 3

"Since until now there have been no objective methods to register pupillary reactions to light and convergence reactions, Soviet physicians doing research in this field have used subjective methods.

"Now, a method of local pupillography is used at the neuro-ophthalmological department of the Institute of Neurosurgery imeni N. N. Burdenko, Academy of Medical Sciences USSR. The method consists of a movie camera which takes pictures of the pupil at a rate of 6-10 frames per second, after the local stimulation of the pupil by light of various intensities and durations. Then, this film is passed through a special apparatus with a diaphragm which registers only the cross sectional diameter of the pupil. Curves obtained from this data make it possible to judge objectively the diameter of the pupil, the speed (amplitude) of its constriction due to light, and the latent period of pupillary reaction to light, etc.

"Such an objective method of studying pupillary reactions used in neuro-ophthalmological practice aids in detecting defects in the visual field and establishes the level of injury to the optic paths.

"This method of pupillography has an additional importance in establishing the (topica) [topography] of the level of various diseases of the brain stem. Therefore, local pupillography means essential aid to neurosurgeons and neuro-ophthalmologists in diagnosing diseases of the central nervous system."

86. Chemical and Physicochemical Changes in Highly Polymerized DNA Due to Radiation Sickness Caused by Polonium

"The Properties of Highly Polymerized Desoxyribonucleic Acid of Liver During Polonium Injuries," by M. S. Uspenskaya, Moscow, Meditsinskaya Radiologiya, Vol 3, No 5, Sep/Oct 58, pp 30-37

The purpose of this research was to study the structural viscosity and chemical composition of DNA of rat liver during various stages of radiation sickness caused by polonium injuries.

Research was conducted on 32 rats, 10 of which served as controls. A solution of polonium nitrate was administered subcutaneously to the experimental animals at the rate of 0.1 millicurie per kg body weight. The animals were sacrificed at various periods of radiation sickness.

A table illustrates the yield of highly polymerized desoxyribonucleic acid (in the form of its sodium salt) obtained from the liver of the irradiated rats, and also simultaneously from the control animals, at various periods of radiation sickness. Another table presents the results of the content of nitrogen and phosphorus in DNA preparations extracted from the liver of healthy rats and from experimental rats at 1, 3, 9, and 13-16 days after the administration of 0.1 millicurie of polonium per kg body weight. Four diagrams illustrate the relative structural viscosity of the highly polymerized desoxyribonucleic acid of rat liver at 1, 3, 9, and 16 days after the administration of polonium.

Experimental data indicate the following:

"1. The structural viscosity of DNA of rat hepatic tissue is decreased on the first and third days after the introduction of polonium, but by the 9th day the degree of its polymerization exceeds the normal value. However, during the terminal stage of radiation sickness DNA is depolymerized again.

"2. One day after the administration of polonium, the nitrogen content of DNA is decreased. The nitrogen level of DNA, extracted from samples of hepatic tissue at later periods during the development of radiation sickness, shows a gradual increase; and toward the terminal period of radiation sickness, the nitrogen level returns to normal values

"3. On the third day after exposure to polonium and also during the terminal period of radiation sickness, there is a slight decrease in the phosphorus content of the highly polymerized preparations of DNA."

The author concludes that the chemical and physicochemical changes occurring in hepatic DNA during radiation sickness caused by the incorporation of polonium serve as an index for the changes in the specific structure of the naturally occurring molecule of DNA and, no doubt, represents an important factor in the disturbance of the normal cell activity of a living cell.

87. Hematological Shifts During Acute Radiation Sickness due to Betatron Irradiation

"Hematological Shifts in Animals Suffering Acute Radiation Sickness Caused by Betatron Irradiation," by G. P. Garganeyev, Chair of Pathophysiology (head, Prof D. I. Gol'dberg), Tomsk Medical Institute; Moscow, Problemy Gematologii i Perelivaniya Krovi, Vol 3, No 5, Sep/Oct 58, pp 3-9

The aim of this research was to study hematological shifts in animals showing radiation injuries caused by betatron irradiation. Tests were conducted on four groups of guinea pigs subjected to a single general irradiation using no filters by 7,300, 3,600, 1,824, and 480 r.

Three diagrams illustrate the reaction of peripheral blood to irradiation by 1,824, 3,600, and 7,300 r respectively. A table shows changes in leukocyte count after irradiation by 1,824 r. Three additional diagrams illustrate the dynamics of the number of reticulocytes after irradiation by 1,824, 3,600, and 7,300 r.

Results indicate that all the animals of the first group died within 7-11 hours in an epileptic state which commenced immediately after irradiation. The animals of the second group died in 7-9 days with the exception of one animal that died in about 20 hours. The animals of the third group irradiated with 1,824 r died within 6-11 days, but only one guinea pig showed signs of epilepsy and died in about 9 hours. All animals except one of the fourth group lived for more than 100 days.

All the animals, except those that died within the first few hours, lost an average of 50% of their original weight. All the animals of the first group died in a state of pronounced leukopenia, although, in general, the curves for leukocyte, lymphocyte, and neutrophile counts undulated.

During the period of leukopenia, the number of neutrophiles decreased more sharply than that of lymphocytes. Morphological changes in neutrophiles appeared in 1-3 hours, while changes in lymphocytes, monocytes, eosinophiles, and basophiles became evident after several hours or up to one day. Earliest changes observed in neutrophiles consisted of nuclear fragmentation, then chromatinolysis, and pyknosis. Changes in erythrocyte count and hemoglobin percentage were not significant.

A single dose of 480 r from betatron caused a small transitory decrease in reticulocyte count during the first few hours after irradiation.

No ratio was observed between the value of the dose and the degree of leukocytosis, although leukocytosis was evident during the first few hours in many cases.

Reticulocyte count decreased sharply following irradiation by 1,824, 3,600, and 7,300 r gamma rays. The reticulocytes disappeared from the peripheral blood during the first 2 hours after irradiation, and were absent from circulation just before death.

The erythocyte sedimentation rate was accelerated only during the last days of life of animals irradiated by 480 r

88. Changes in External Respiration Due to General Irradiation by X Rays and Gamma Rays, and Due to Preferential Irradiation of the Head Alone

"Changes in External Respiration Due to General X-Ray and Gamma-Irradiation (Experimental Roentgenokymographic Research)," by R. M. Rabinovich, Central Scientific Research Roentgeno-Radiological Institute, Ministry of Health USSR; Moscow, Meditsinskaya Radiologiya, Vol 3, No 5, Sep/Oct 58, pp 7-11

This research was based on a method using roentgenokymographic apparatus to study the external respiration of 12 rabbits. Nine of these rabbits were subjected to a general irradiation (three to X-ray irradiation, and six to gamma-irradiation from radioactive Co-60), and three rabbits were subjected to irradiation of the head by the contact method of laying a preparation of radioactive cobalt directly on the head.

Results are illustrated by four pairs of roentgenokymographs showing changes in external respiration due to irradiation.

Experimental results are summarized as follows:

"1. General irradiation by ionizing radiation retards the rate of external respiration and changes the relationships of the various phases of respiration. The changed respiration returns to normal 24 hours after irradiation is discontinued.

"2 The retardation of respiration due to general irradiation may be accompanied by increased amplitude of individual respiratory periods.

"3. The preferential irradiation of the head alone causes changes in respiration which are analogous to those observed due to general irradiation except that they are more stable."

89. Changes in Physicochemical Properties of Desoxyribonucleic Acid in Tissues of Irradiated Animals Studied

"Changes in Physicochemical Properties of Desoxyribonucleic Acid in Tissues of Irradiated Animals," by G. P. Toropova and N. V. Yermolayeva; Moscow, Meditsinskaya Radiologiya, Vol 3, No 5, Sep/Oct 58, pp 24-29

The aim of this research was to study the chemical composition and certain of the physical properties of highly polymerized preparations of desoxyribonucleic acid extracted from nuclei isolated from hepatic cells and from nuclei of the cells of the mucous membrane of small intestines of rabbits after various periods of their irradiation by minimal absolute lethal doses of 1,000 r X rays.

Tests were conducted on 30 rabbits. The animals were sacrificed at 3, 6, and 24 hours and 3 and 6 days after their irradiation. Details of the method of extraction, purification, absorption, and determination of DNA are included. Four diagrams illustrate structural viscosity and absorption spectra of preparations of desoxyribonucleic acid extracted from the nuclei of hepatic cells and from cells of the mucous membrane of intestinal walls.

Results indicate that 3 hours after irradiation the nitrogen level in DNA protein (DNAP) in intestinal cells drops by 16%, while its phosphorus level drops by 6%, and the pentose level drops by 7%. During this same period, the ratio of nitrogen to phosphorus drops from the normal 1.67 to 1.47. After a 6-hour interval, the drop in N, P, and Pentose (compared with normal nonirradiated tissue) was 16%, 4.2%, and 5.5%, respectively. After 24 hours, there is a rise in the nitrogen value, and the previous drop is decreased to 9%. The nitrogen to phosphorus ratio rises to 1.58. On the 6th day after irradiation, there was further normalization of chemical composition of desoxyribonucleic acid, and the ratio of nitrogen to phosphorus and nitrogen to pentose returned to normal. Changes in structural viscosity also were studied. Maximum absorption spectra of solutions of desoxyribonucleic acid of irradiated animals were determined in the range of 260-263 millimicrons, and essentially did not differ from the controls.

Similar studies were conducted on the chemical structure and physical properties of desoxyribonucleic acid with regard to the nitrogen to phosphorus ratio and nitrogen to pentose ratio in desoxyribonucleic acid molecule in the proteins of the nucleus of hepatic cells.

In general, the changes had a phasic nature. Restoration to normal occurred sooner in the intestinal tissue than in the hepatic tissue, indicating that desoxyribonucleic acid extracted from hepatic cells with respect to its chemical composition and viscosity is more radiosensitive than desoxyribonucleic acid extracted from cells of intestinal walls. The ratio between phosphorus and pentose remained within normal limits throughout the experimental period, indicating that the ester bond between phosphorus and desoxypentose in desoxyribonucleic acid molecule remains essentially undisturbed all through radiation sickness.

90. Disturbances in Protein Metabolims During Acute Radiation Sickness Indicate Profound Cytological Injuries

"Protein Metabolism in the Nuclei of Hepatic Cells and in the Cells of Small Intestines During Experimental Acute Radiation Sickness," by L. I. Il'ina; Moscow, Meditsinskaya Radiologiya, Vol 3, No 5, Sep/Oct 58, pp 20-24

The aim of this research was to study the content and the rate of synthesis of the proteins of cell nuclei, i.e., desoxyribonucleo-proteins (DNAP), and also to study the acid and "residual" proteins in the nuclei of hepatic cells and in the cells of the mucous membrane of small intestines during acute radiation sickness.

Tests were conducted on white rats subjected to total irradiation by 800 r from X rays. One series was sacrificed 3 days after their irradiation, and a second series was sacrificed 3 1/2 hours after the administration of S^{35}-methionine in 0.5 ml quantities calculated on the basis of 0.03 microgram per g body weight. Details on the methods of determination and protein fractionation of various protein components of the nuclei are included.

Experimental data illustrate that X-ray irradiation causes sharp changes in the relative level of all proteins in the cell nuclei. The level of DNAP in hepatic cells of irradiated rats is diminished by 50%. The level of acid proteins is increased by 68%. The content of "residual" protein is increased by a factor of 5. Similar changes occur in the nuclei of the cells of the mucous membrane of small intestines. The DNAP level drops by 35%, acid protein content is increased by 40%, and "residual" protein is increased by a factor of 10. All figures are compared with normal unirradiated rats.

Data on the second series of animals, involving the inclusion of S^{35} methionine into hepatic cells and into cells of the mucous membrane of small intestines in irradiated and normal rats, indicate that X-ray irradiation leads to the increased inclusion of the sulfur-containing amino acid in all the proteins of hepatic cell nuclei. In the cells of the mucous membrane of the small intestine there is a distinct rise in the inclusion of the tracer elements in the acid proteins of the nuclei, while the inclusion of S^{35} methionine in DNAP and "residual" protein is within normal limits.

The author concludes that ionizing radiation disturbs those mechanisms which regulate the equilibrium between the rate of protein synthesis and decomposition. This disturbance is serious because the content of the basic protein of cell nuclei, i.e., DNAP, is reduced by 50% [in hepatic cells]. This diminution of DNAP points to profound disturbances in the metabolism of cellular nuceli and cell division and leads to the usual cytological picture of injured cells.

91. Treatment and Changes in Vascular Supply of Wounds at Various Periods in Radiation Sickness

"The Dynamics of Changes of the Vascular System of Wounds at Various Periods of Acute Radiation Sickness," by V. S. Dmitriyeva, Chair of Maxillary-Face Surgery (head, Prof N. M. Mikhel'son), Central Institute of Traumatology and Orthopedics (director, Prof N. N. Priorov, Active Member, Academy of Sciences USSR), Ministry of Health USSR, and Chairs of Operative Surgery and Clinical Anatomy (head, Prof B. V. Ognev, Corresponding Member, Academy of Medical Sciences USSR), Central Institute for Advanced Training of Physicians; Moscow, Eksperimental'naya Khirurgiya, No 5, Sep/Oct 58, pp 41-45

The aim of this research was to study the changes in the vascular system at various periods of acute radiation sickness following the surgical treatment of wounds by various types of surgical intervention depending on the degree of acute radiation injuries. The maxillary region was selected for these studies because it is very rich in its vascular supply.

Results indicate the following:

1. Definite pathological changes take place in the vascular system surrounding the wound at various periods of acute radiation sickness, depending on the dose of irradiation.

2. During the period of initial reactions (3-6 hours) the vessels are dilated and atypical, and following large doses they are partially destroyed.

3. During the latent period (24-48 hours) changes appearing in the vascular system vary; 24 hours after irradiation the vessels are constricted, atypical, and intact; 48 hours after irradiation, the vessels are sharply dilated, atypical, and partially destroyed.

4. During the peak of radiation sickness (12-15 days) the vessels are dilated and atypical. Especially sharp changes are noted following large doses of radiation (600 r), cell intactness is disturbed, and there is no swellings at the ends of branching vessels. In the area of the wound and the surrounding tissues there are few blood vessels.

5. During the period of recovery (25-30 days) the vascular system surrounding the wound is restored. The number of vessels is increased and atypical structure is less apparent, but the dilatation of vessels persists especially following large doses of radiation.

6. The dynamics of changes in the vascular system confirm that the best time for surgical intervention afte. any dose of radiation is 24 hours, i.e., during the latent period and during recovery (25-30 days).

7. After small doses of irradiation (200-400 r) all types of surgical intervention may be performed during the period of initial reactions (3-6 hours), after 48 hours (latent period), and during the period of peak radiation sickness. After large doses (600 r) only primary, delayed primary, and secondary sutures may be put in during these periods.

92. Increased Radioresistance Linked to Rise in Properdin Level Following Blood Loss

"The Effect of Blood Loss on Properdin Level in Dogs" (Preliminary report), by I. L. Chertkov, L. S. Rogacheva, and L. L. Shepshelevich, Central Institute of Hematology and Blood Transfusion (director, Prof A. A. Bagdasarov, Active Member, Academy of Medical Sciences USSR), Ministry of Health USSR, Moscow, Problemy Gematologii i Perelivaniya Krovi, Vol 3, No 5, Sep/-Oct 58, pp 14-16

Since a recently discovered protein, properdin, has been discovered in the blood and seems to be an important factor in natural immunity, the authors studied the effect of blood loss on properdin level.

Two dogs were subjected to a single massive blood loss of 25 ml/kg body weight. Results determined immediately after blood loss showed decreased level of blood properdin, but determinations run 21 days later showed a rise in the blood properdin level.

Repeated blood letting experiments on two other dogs proved that blood loss inhibited the decrease of blood properdin level and often had a stimulating effect on it.

Extracts of plasma from the blood of a dog made anemic by daily (for a 10-day period) blood letting of 3 ml/kg administered to a second dog increased the properdin level in the latter and in 24 hours the level rose from the normal of 8 units per ml to 24 units per ml.

According to Bagdasarov and his colleagues, the activation of hemopoiesis caused by blood loss increases the resistance of animals to the effect of ionizing radiation.

The authors conclude that stimulation of the hemopoietic apparatus is accompanied by the stimulation of the properdin system of an organism. Furthermore, one may postulate that the increased activity of the properdin system plays a definite role in the mechanism of radioresistance arising after blood loss. In addition, the link between hemopoiesis and the properdin system opens additional pathways for research on the physiological mechanisms of properdin formation.

93. Desensitization Effect of X Rays Attributed to Their Anelectrotonus

"The Effect of Ionizing Radiation on the Functional Condition of the Respiratory Center of Rabbits," by L. G. Terekhova, Institute of Experimental Medicine (director, Prof D. A. Biryukov), Academy of Medical Sciences USSR, and Chair of Normal Physiology (head, Prof D. A. Biryukov), First Leningrad Medical Institute; Moscow, Meditsinskaya Radiologiya, Vol 3, No 5, Sep/Oct 58, pp 11-14

Several authors have demonstrated that general X-ray irradiation alleviates the symptoms of anaphylactic shock and retards the development of the phenomenon of Arthus; however, the mechanism of the desensitization effect of ionizing radiation is still unknown. Therefore, the author studied the effect of X-ray irradiation on the functional condition of the respiratory center and on the course of sensitization of nerve cells of the respiratory center.

Tests were conducted on 21 rabbits, classified into four groups:

Group (1), three rabbits, sensitized by a double dose of 1.0-1.4 ml horse serum.

Group (2), six rabbits, irradiated by 600, 900, or 1,000 r and served as controls.

Group (3), six rabbits, irradiated and then sensitized.

Group (4), six rabbits, sensitized and then irradiated.

Results prove the following:

"1. General X-ray irradiation produces an effect on the functional condition of the respiratory center, which is expressed by changes in the nature of the respiration of animals. The respiratory movements lose uniformity of amplitude and regularity of rhythm.

"2. Initial irradiation of sensitized animals significantly alleviates the seriousness of the symptoms of both local and general anaphylaxis and prevents the onset of lethal out-come.

"3. Subsequent irradiation of sensitized animals does not decrease severity of the acute symptoms of either local or general anaphylaxis, but only prevents the onset of lethal outcome due to the effect of the specific horse serum.

"4. General X-ray irradiation may be considered as one means of desensitizing animals, and its mechanism evidently is connected with the presence of an anelectrotonic effect of roentgen rays."

94. Vitamin B_{12} Ineffective in Stimulating Hemopoiesis in Normal and Irradiated Organisms

"The Effect of Vitamin B_{12} on the Blood of Normal and Irradiated Organisms," by G. D. Berdyshev, Chair of Biology (head, Prof V. V. Reverdatto) and Chair of Pathophysiology (head, Prof D. I. Gol'dberg), Tomsk Medical Institute; Moscow, Problemy Gematologii i Perelivaniya Krovi, Vol 3, No 5, Sep/Oct 58, pp 9-14

Due to the great controversy over the effectiveness of vitamin B_{12} in eliminating the symptoms of radiation sickness, increasing the survival rate of animals, stimulating hemopoiesis in irradiated animals, increasing the erythrocyte count, and decreasing the thrombo-plastic activity of the blood, the author conducted this research on the effect of excess amounts of vitamin B_{12} on the stimulation of hemopoiesis.

Vitamin B_{12} was administered to two healthy men in the form of a single intramuscular injection of 30 gamma. The results showed a temporary decreased erythrocyte counts, by 920,000 and 2 million, respectively, within 2 days; a slight decrease in hemoglobin percent; a slight increase in reticulocytes; and no change in the leukocyte count or in the hemogram.

Single intramuscular injections of 20 gamma of vitamin B_{12} were administered to six rabbits, and the results were similar to the preceding ones. Repeated subcutaneous daily injections of 7.5 gamma of vitamin B_{12} were administered to 12 white rats with similar results.

The author, therefore, concludes that vitamin B_{12} administered parenterally produces no stable changes in the blood picture of healthy men, rabbits, or mice, and that these results confirm that vitamin B_{12} administered to normal organisms does not stimulate hemopoiesis.

In a second series of tests vitamin B_{12} was administered to 18 guinea pigs, and 96 white mice subjected to mild X-ray irradiation by 250 r. Both species of animals were classified into groups that received daily subcutaneous injections of vitamin B_{12} before irradiation, after irradiation, and both before and after irradiation. Results indicate that the degree and duration of leukopenia in the experimental and control animals were analogous. Rate of survival during a 41-day period after irradiation showed no significant differences in the four groups of animals. Data on changes in hemoglobin, erythrocytes, and leukocytes in mice and guinea pigs and on reticulocyte content in mice were also negative.

The author concludes that these results do not prove a favorable effect of vitamin B_{12} on hemopoiesis in mice and guinea pigs irradiated by moderate doses of X-rays.

Surgery

95. Reparative Processes of Muscles Accelerated if Defects Due to Gaps Are Filled With Minced Muscle Tissue

"Protein Synthesis and the Function of a Muscle When a Defect in It Is Filled With Minced Muscle Tissue," by K. I. Gavrilova (deceased), L. S. Romanova, and A. S. Gurvich, Institute of Surgery imeni A. V. Vishnevskiy (director, Prof A. A. Vishnevskiy, Active Member, Academy of Medical Sciences USSR), Academy of Medical Sciences USSR, and Laboratory of Neurohistology imeni B. I. Lavrent'yeva, Institute of Normal and Pathological Physiology, Academy of Medical Sciences USSR; Moscow, Eksperimental'naya Khirurgiya, Vol 4, Jul/Aug 58, pp 14-20

The aim of this research was to study the restoration of function and the parallel processes of protein synthesis in various parts of injured muscle at various periods after the infliction of an injury, and then the effect of filling of the gaps with minced muscle tissue. Tests were conducted on rabbits, and both auto- and homografts of minced muscle tissue were used. Results prove the following:

"1. After removal of part of a muscle and filling the defect with minced muscle tissue, the intensity of protein synthesis at the site of the graft and in the parts of muscle adjacent to the graft was several times the level of protein synthesis in control uninjured muscles, during the whole period of the experiments, i.e., 6 days to 4 months.

"2. The activation of protein synthesis in all enumerated parts of the injured muscle tissue is most evident during the first month, but decreases noticeably during the 2d to the 4th months.

"3. Toward the end of the 4th month after the operation, the restoration of function, as judged by the threshold of stimulation and the amplitude of contraction, in the muscles whose defects had been filled with minced muscle tissue differed little from that of the uninjured muscles.

"4. The threshold of stimulation was significantly higher than that of uninjured muscles in muscles in which the defect was not filled with minced muscle tissue at all times after the operation, and there was only a slight contraction amplitude even 4 months after the operation.

"5. These investigations confirm the fact that reparative processes in rabbits proceed significantly better in muscles in which the gaps created by removal of part of a muscle are filled with minced muscle tissue than if the gaps are not filled."

Veterinary Medicine

96. Foot-and-Mouth Disease in Calves

"Pathological-Anatomical Changes in the Calf Heart in Foot-and-Mouth Disease," by F. V. Khomitskiy, Tr. Turkm. S.-Kh. In-ta (Works of the Turkmen Agricultural Institute), No 8, 1956, pp 137-140 (from Referativnyy Zhurnal -- Biologiya, No 9, 10 May 58, Abstract No 40622, by I. B. Barabash)

"Aphthae on the skin and mucous membranes were not observed in calves from 2 weeks to one year old. Pronounced changes in the heart were found in varying degrees in ten calves, frequently in the wall of the left ventricle and the cardiac septum in the form of focal productive myocarditis. As a result of the comparatively rapid deaths of the calves, scar tissue was not observed."

97. Management of Foot-and-Mouth Disease in Calves

"Prophylaxis and Therapy of Foot-and-Mouth Disease in Calves," by Dzhmukhadze, Byul. Nauchno-Techn. Inform. Gruz. N.-I. In-ta Zhivotnovodstva i Vet. (Bulletin of Scientific and Technical Information, Georgian Institute of Animal Husbandry and Veterinary Medicine), No 2, 1957, pp 42-43 (from Referativnyy Zhurnal -- Biologiya, No 9, 10 May 58, Abstract No 40623, by L. S. Kirichenko)

"The author successfully used citrated convalescent blood preserved with a 0.5% solution of carbolic acid for therapeutic and prophylactic purposes (on 2,350 animals, 42 of which were sick). Three of the animals died, and the rest recovered. Disease was not noted for 10 days in animals treated for prophylactic purposes although they were in contact with sick animals. Preserved, citrated convalescent blood retained its immunogenic characteristics for 5-7 days."

98. Vaccination Against Hog Cholera

"Intracutaneous Vaccination of Swine Against Plague With Glycerinized Vaccine," by I. V. Okuntsov, Byul. Nauchno-Tekhn. Inform. Sibirsk. N.-I. Vet. In-ta (Bulletin of Scientific and Technical Information, Siberian Institute of Veterinary Medicine), No 2, 1957, pp 21-22 (from Referativnyy Zhurnal -- Biologiya, No 9, 10 May 58, Abstract No 40633)

"The effectiveness of the intracutaneous method of administering vaccine was demonstrated on 23,187 swine including pregnant and recently delivered, sows and piglets from 2 months of age). The vaccine was introduced into the middle third of the ear in two doses of 0.5-1.0 ml at 7-day intervals."

Miscellaneous

99. Medical Science in China

"Science in New China Serves the People," by Prof I. Kochergin, Corresponding Member, Academy of Medical Science USSR; Moscow, Meditsinskiy Rabotnik, 30 Sep 58, p 4

During the celebration of the anniversary of the People's Republic of China, the Chinese are taking note of their tremendous progress in all fields of cultural activity and in every segment of the national economy.

Medical science has contributed greatly toward improved health services to the Chinese population. The national Twelve-Year Plan calls for solution of some 50 scientific problems, among which the study of regional pathology has a very high priority. The Twelve-Year Plan emphasizes closer ties between theory and practice and a scientific research effort directed toward solving the most important problems which concern the health of the people.

A huge network of scientific research institutes, stations, and laboratories is in operation in China. There are institutes of parasitology, epidemiology and microbiology, vaccines and serums, tuberculosis, industrial hygiene and occupational diseases, medical preparations and scientific medicine, and the Central Research Institute of Traditional Medicine with its large division of acupuncture and moxibustion. In addition to these, many large hospitals maintain their own scientific research laboratories.

The Chinese Academy of Medical Sciences was established in 1957 when the large, all-embracing scientific research establishment, the former medical institute SEKhE [Central Institute of Health] became part of the academy. The mission of the academy is to provide leadership for the country's research effort in the medical sciences.

Medical universities give considerable attention to scientific work. With the aid of state research laboratories, they organize research groups in comprehensive medicine and in the specialties. Comprehensive research teams are made up of scientists who are specialists in their fields. Experience has demonstrated that such planning and organization contribute considerably toward efficient research.

The First and Second Medical Colleges of Shanghai have acquired considerable experience in medical research. More than a dozen chairs there carry on comprehensive research and experiments. Practicing physicians from various district and provincial medical establishments have been doing research at those colleges.

Medical scientists at the Wuhan Medical College are doing research in industrial hygiene and occupational diseases. A total of 50 people, representing nine different chairs, are carrying on scientific research in the laboratories of this college and of one of the largest industrial establishments. The college reportedly has made concrete proposals for better working conditions and proper nutrition and rest.

The people at Sian Medical College are investigating the epidemiology, clinical picture, and treatment of Kashin-Beck's disease. The chairs of hygiene, surgery, faculty therapy, microbiology, pathologic anatomy, biochemistry, and roentgenology cooperate with the sanitary-epidemiological stations nearby.

Scientists of five chairs of Szechwan Medical College have completed work on medicinal plants. Various regions are surveyed during studies in plant morphology, pharmacodynamics of some alkaloids, and quantitative methods of identification of active substances.

The Central Committee of the Chinese Communist Party and the central government have placed before health agencies the task of eradicating as soon as possible one of the most widespread diseases -- schistosmoiasis.

Medical scientists, biologists, and other specialists have been working in close cooperation with practical workers of medical and agricultural establishments. Direct leadership has been provided by party and government agencies. As a result, the principal epidemiological characteristics, clinical course, and consequences of schistosomiasis have been pinpointed. Scientific data indicate the possibility of exterminating the interstitial schistososa and rendering its eggs harmless. Effective means of proctecting individuals from this parasite are in the process of being developed.

Progress has also been made toward developing mass treatment methods for this disease. The original plan called for complete eradication by 1959, but it seems now that the cure of all schistosomiasis patients will not be completed until 1960-1961.

Much work has been done to determine the natural reservoirs of some particularly dreaded diseases. The Ministry of Health of the Chinese People's Republic sent expeditions to certain areas to study the problem. Soviet scientists took part in a few of such expeditions. On the basis of material collected, it is now more or less possible to chart these reservoirs of infections and plan preventive measures.

A number of scientific establishments, particularly the laboratories of the Chinese Academy of Medical Sciences, have been conducting research on virus diseases. Special attention has been given to epidemic encephalitis. New vaccine against encephalitis has been developed from local strains. Preliminary tests showed that this vaccine confers greater specific immunity with milder reactions. Results of studies lend credence to the possibility that the virus is carried in the ovaries of mosquitoes and passed on from one generation to another through ova. It was also found that encephalitis B virus can live in subcutaneous tissue. Preliminary data indicate that subcutaneous injection of encephalitis B virus considerably increases immunogenicity and reduces its pathogenic property. It is supposed that strains can be obtained for preparation of living encephalitis vaccine by this process.

Much work has been done in the study of medicinal preparations (antimalarials antihelminthics, analgesic, and hypotensive drugs). This is important as about 80% of all drugs used in China are derived from medicinal plants.

Studies have yielded preliminary knowledge of the mechanisms of acupuncture and moxibustion. It was found that the bases of these Chinese methods of treatment are reflex actions.

Much attention is given to such problems in clinical medicine as experimental atherosclerosis, and protein chemistry. A number of scientific establishments are studying experimental atherosclerosis.

Research in protein chemistry is important. Scientists have developed methods of separating bovine blood plasma fractions and have succeeded in obtaining albumin, gamma globulin, prothrombin, and fibrinogen in pure form.

Profitable work has been done in the Chinese Academy of Medical Sciences on the chemical composition of staple foods, particularly those of plant origin. A good substitute for cow's milk has been found. Its main ingredients are rice, soya, and egg yolk powder. It has been shown that its composition and food value differs little from that of natural milk.

After a study of the protein content of [certain staple] foods of plant origin, it was concluded that those foods contain adequate amounts of the essential amino acids and methionine.

Many scientific research establishments and chairs of medical universities have been carrying on extensive research in physiology, pathologic physiology, morphology, pathologic anatomy, etc. Interesting work has been done in the study of cirrhosis of the liver and pathogenesis of incipient cancer of the liver.

Worthy of note is China's progress in thoracic surgery. Intensive practical work and experiments have been conducted in that field by scientific establishments and chairs of the universities of Shanghai, Peiping, Hangchow, and others.

Chinese scientists and medical practitioners maintain constant contact with Soviet medical men. Such scientific cooperation and aid is mutually advantageous. It is not surprising that it grows and becomes stronger from year to year.

100. New Medical Institute Established in Grodno, Belorussian SSR

"Still Another Vuz is Opened" (unsigned article); Moscow, Meditsinskiy Rabotnik, 31 Oct 58, p 4

Recently opened was the Grodno Medical Institute (Grodnenskiy Meditsinskiy Institut) located in Grodno, Grodnenskaya Oblast, Belorussian SSR. The institute has eight science buildings and dormitories. The institute is staffed by well-qualified instructors and specialists. Over 90 percent of all students in Grodno who are attending the three vuzes (higher educational institutions) in the city are to be enrolled in the first year course of the Grodno Medical Institute.

101. New Institute of Roentgenology, Radiology, and Oncology Opened in Tashkent

"New Scientific Center in Uzbekistan" (unsigned article); Moscow, Meditsinskiy Rabotnik, 29 Aug 58, p 2

A new Scientific Research Institute of Roentgenology, Radiology, and Oncology (Nauchno-Issledovatel'skiy Institute Rentgenologii, Radiologii i Onkologii) has been opened in Tashkent. This makes the ninth scientific research medical institute to be established in the Uzbek SSR. The director of the institute is Prof D. Abdurasudov. The new institute will be responsible for all research in the field of roentgenology, radiology, and oncology within the republic.

The institute has the following divisions: Experimental Pathology, X-Ray Diagnosis, X-Ray Therapy and Telegram Therapy, and Clinical, Oncological, Scientific-Technical, and Organizational-Methodological.

102. New Institute of Physiology and Pathology of Women Established in Tbilisi

"Institute of Physiology and Pathology of Women" (unsigned article); Moscow, Meditsinskiy Rabotnik, 24 Oct 58, p 3

An Institute of Physiology and Pathology of Women (Institut Fiziologii i Patologii Zhenshchiny), Ministry of Health Georgian SSR, has been established in Tbilisi. Prof I. F. Zhordania, director of the institute, states that his institute is the first of its kind in the USSR. The basic aim of the institute is to increase the birth rate by decreasing the incidence of abortions and to find the solution to the problem of infertility.

The institute will have a 50-bed clinic, corresponding laboratories and divisions, and a marriage consultation bureau.

103. Semiprofessional Medical Workers Get Specialized Training

"Courses for Semiprofessional Medical Workers" (unsigned article); Moscow, Meditsinskiy Rabotnik, No 83, 17 Oct 58, p 3

"In 46 oblasts, regions, and autonomous republics of the Russian Federation, courses, partly on an uninterrupted basis, are being offered to increase the qualification and specialization of semiprofessional medical workers. These courses are taught to full-time students at local medical institutes and therapeuto-prophylactic establishments. The period of instruction varies between 1 1/2 and 4 months.

"Specialization courses prepare medical nurses in plaster techniques, blood transfusion, radium therapy, dietetic feeding, climatotherapy, balneotherapy, hearing prosthetics, anesthetics, roentgeno-laboratory [methods], etc."

104. Congress of Therapists of RSFSR To Be Held in December 1958

"Congress of Therapists of the RSFSR" (unsigned article); Moscow, Meditsinskiy Rabotnik, 24 Oct 58, p 4

The First All-Russian Congress of Therapists, which was scheduled to open in October 1958, has been postponed until 8 December 1958. The congress will last 6 days. Registration of delegates will be held from 6 to 7 December in the Ministry of Health RSFSR (Vadkovskiy, per., D. 18/20).

105. Second Congress of Surgeons To Be Held in May 1959

"From the Administration of the Republican Scientific Society of Surgeons," Zdravookhraneniye Kazakhstana, No 6, 1958, p 70

"A Second congress of surgeons of Kazakhstan is expected to be held during the second half of May 1959.

"The following questions are to be discussed:

"1. Some questions of organization of surgical and traumatological service in the republic.

"2. Goiter.

"3. Cancer of the esophagus and of the stomach.

"4. Questions dealing with surgical treatment of tuberculosis of the lungs and tuberculosis in the bones and lymphatic glands.

"5. Cholecystitis.

"The administration of the society is requesting that all those desiring to read a report at the second congress submit the title and theme of his report on or before 1 November 1958.

"Complete texts of all reports must be in on or before 1 February 1959.

"All material connected with the congress must be sent to the following address: City of Alma-Ata, Ul. Panfilova 112; Ministry of Health Kazakh SSR; Organizational Committee (Orgkomitet) of the Second Congress of Surgeons.

106. Conference on Biophysics of East German Physics Society

Berlin, National-Zeitung, 15 Oct 58

The fourth working conference on biophysics of the East German Physics Society will be concluded at Oberhof on 15 October 1958. Well-known scientists from Hungary, Bulgaria, and West Germany are participating in the conference. More than 40 lectures are on the agenda. Some of the lectures are to deal with problems of protection against radiation and of the effects of radiation on biological tissues. Prof Dr Herbst of Freiburg/Breisgau examined the problems of radioactive contamination.

107. Modification of High-Pressure Boiler Steel Composition

"Concerning a Steel for High-Pressure Vessels," by Engr A. S. Zhuravlev; Leningrad, Energomashinostroyeniye, No 7, Jul 58, pp 45-47

Change in chemical composition of steel 22K is recommended by the Barnaul Boiler Plant as the result of statistical analysis of given data on chemical composition and mechanical properties of sheets prepared from 250 melts of this steel from the Izhorsk Plant and 130 from the Yuzhnyy Plant.

Steel 22K as applied in construction of welded high-pressure vessels (100-320 atm) has the following chemical composition: 0.19-0.26% C; 0.7-1.0% Mn; 0.2-0.4% Si; $\leq$ 0.4% Cr; $\leq$ 0.3% Ni; $\leq$ 0.3% Cu. Yield strength is 24 kg/mm^2 and tensile strength is 44 kg/mm^2. Melts of this steel from the Yuzhnyy Plant had higher content of Cr and Si and higher strength characteristics than those of the Izhorsk Plant although the content of C and Mn were about equal. Steel 22K from the Izhorsk Plant was considered unsatisfactory for high-pressure vessels due to high divergence of characteristics. Tests on heat-treated vessels with 70-155 mm thick walls and weighing 20-50 tons showed a 2-3 kg/mm^2 drop in yield strength and a 1-2 kg/mm^2 drop in tensile strength of the vessel material as compared with the basic sheet material.

Recommendation is made that the chemical composition of steel 22K be changed to 0.20-0.26% C, 0.8-1.0% Mn, 0.15-0.30% Si, $\leq$ 0.4% Cr, $\leq$ 0.3% Ni, and $\leq$ 0.3% Cu and that the steel be redesignated as steel 23K. Yield strength of this steel is 27 kg/mm^2 and tensile strength is 46 kg/mm^2. Thinner walled vessels and better material economy are expected with this steel.

108. Chinese Report on High-Temperature Alloys

"Scientific Conference on Heat Stability Convened by Northeast People's University and Institute of Mechanical and Electrical Engineering, Academia Sinica," by Metal Physics Research Group, Department of Physics, Northeast People's University; Peiping, K'o-hsueh T'ung-pao (Scientia), No 16, 1958, pp 507-508

"A scientific conference on heat stability was held in Ch'ang-ch'un on 9 July 1958 by Northeast People's University in collaboration with the Institute of Mechanical and Electrical Engineering [Electromechanics] of the Academia Sinica. The conference, organized with the help of Malyshev, a Soviet specialist, was attended by representatives from research establishments, industrial plants, and higher schools all over the country. The purpose of the meeting was to exchange views on heat stability, particularly as related to research on the Fe-W-Si alloy system, and to promote better cooperation.

"When Malyshev came to China in 1956 to help train graduate students and develop Chinese research, he proposed the Fe-W-Si alloy system for our consideration. It was best suited to the needs of national construction and to our national resources situation. For that system could provide heat-stable steels needed for every application from steam boilers to gas turbines, and could change China's state of dependency on other countries for high-temperature nickel and cobat steels. Furthermore, materials which could withstand temperatures above 1,000 degrees centigrade are urgently needed for the development of jet planes, rockets, and artificial satellites. We are of the opinion that research on the Fe-W-Si alloy system holds promise for building China's own system of high-temperature alloys and must be pursued.

"Forty reports were presented during the 3 days which immediately preceded the conference. On the first day, there were papers dealing with the basic problems of strength and heat stability of materials. Strength and the electron theory of metals, investigation of the strengthening action of alloying elements, problems on alloy structure and K-state [sic], the Rebinder effect, and surface lubrication physics, were some of the topics.

"Papers presented on the second day pertained to research on the heat stable alloys and included studies on the influence of grain size and properties of grain boundary on creep, the mechanism of creep, low-chrome and chromeless high-speed steels, solid state lubrication, high-temperature abrasion, fatigue and strength at elevated temperatures, and internal friction. Much of the work reported concerned the Fe-W-Si system. New views concerning the mechanism of creep and the influence of grain size brought forth much discussion.

"Reports on research on the Fe-W-Si system were presented on the third day. Although research was initiated as late as April 1958, some noteworthy achievements have been made by the teaching staff and the nearly 70 senior students of the Department of Metal Physics of Northeast People's University and by scientists at the Institute of Mechanical and Electrical Engineering. In the beginning of our research program, we investigated the equilibrium diagram for the Fe-W-Si system, hoping to clarify the location of alpha-solid solution. For although it was the accepted notion in other countries that only austenitic steels are suitable for high-temperature alloys, we believed that any alloy alpha-solid solution which has no alpha $\rightleftarrows$ gamma transition can serve as the basis of a high-temperature alloy and that it probably would not be inferior to austenitic.

"Next we investigated the influence of alloying elements on the strength of the chemical bonds of iron. For the strength of chemical bonds plays an important part in the degree of heat stability. It was found that tungsten greatly increases the strength of those bonds. This was reflected in studies on creep and microcreep when it was found that the rate of creep was very low for tungsten alloys. Because the heat stability of solid solutions was not high enough to satisfy our needs, we investigated factors which may enhance heat stability at elevated temperatures. These studies included the effect of work-hardening on high-temperature strength, the dynamics and action of age hardening, etc.

"We also investigated the influence of alloying elements on the oxidation process of iron and the effect of surface protection [against oxidation]. It is generally known that oxidation of tungsten and molybdenum alloys presents a serious problem. However, this can be overcome, particularly in the case of tungsten alloys. We also studied the wear resistance and heat endurance limit of some alloys. Preliminary results indicated that (1) tungsten strengthens the chemical bonds of solid solutions and enhances their respective high-temperature strengths; at present we have alloys of certain composition which are comparable to austenitic Ni or Co steels in creep strength; (2) dispersion hardening can further raise the coefficients of utilization for the strengthened chemical bonds of certain alloys; (3) silicon and small amounts of other elements will give alloys resistance to oxidation comparable to

that of austenitic nickel and austenitic cobalt steels; (4) Fe-W-Si alloys have very high heat endurance limits; and (5) alloys of this system have higher wear resistance than austenitic steels and nickel base alloys.

"The consensus expressed during the discussions was that the direction of our research is appropriate and promising. Experts such as Ch'ien Lin-chao (钱 临 照) even pointed out that there is political significance in our work. In the first place, the Fe-W-Si system calls for elements which are abundant in China and therefore provides a means by which China can build up its own high-temperature alloys system. Secondly, our work disproves the idea common in other countries that tungsten cannot be used for high-temperature materials in the near future. But we believe the difficulties can be overcome if tungsten must be used for national construction. Another misconception prevalent in other countries is that gamma iron is necessary for high-temperature alloys and that large amounts of nickel, cobalt, and chrome must be used to stabilize and strengthen the gamma form. But we believe that alpha iron is also an excellent basic material, and to stabilize it we can use elements in which China is abundant, namely, tungsten, molybdenum, silicon, and titanium...."

[SIR Note: In the past, the Chinese character combination 機 械 電 机 研 究 所 has been rendered "Institute of Electromechanics" on the basis of the type of work reportedly conducted at the institute. However, the English version offered in this journal is "Institute of Mechanical and Electrical Engineering."]

109. Scientific Research Institute of Metallurgy Organized in Chelyabinsk

"Announcement of Competitions" (unsigned article); Moscow, Promyshlenno-Ekonomicheskaya Gazeta, 17 Sep 58, p 4

Recently established in Chelyabinsk was the Scientific Research Institute of Metallurgy (Nauchno-Issledovatel'skiy Institut Metallurgii) under the Chelyabinskiy Sovnarkhoz. The institute's address is Chelyabinsk, 17, and its telephone number is 6-94-42.

The institute consists of the following two divisions: Nonferrous Metallurgy and Ferroalloys Production, and the following 24 laboratories: Ore Processing, Blast-Furnaces, Steel Melting, Electric Steel Melting, Steel Ingot, Pressure Working of Metals, Heat-Treatment, Heat-Resistant Steel and Alloys, Furnace Heat Engineering, Refractories, Coke-Chemistry, Pyrometallurgy, Hydrometallurgy, Rare Metals, Production of Graphitized

Parts, Furnace Ferroalloys, Pure Metals and Alloys, Furnace Power Engineering, Nonfurnace Ferroalloys, Economic Research, Automation, Metallography, Mechanical Tests, and Chemical Analysis.

[For additional information on Metallurgy, see Item No 45.]

Atomic and Molecular Physics

110. Separation in Inert Gas Discharges Studied

"Investigation of the Mechanism of the Separation of Inert Gases in a Constant-Current Discharge," by S. E. Frish, Corresponding Member of the Academy of Sciences USSR, and N. A. Matveyeva, Scientific Research Physics Institute, Leningrad State University imeni A. A. Zhdanov; Moscow, Doklady Akademii Nauk SSSR, Vol 122, No 3, 21 Sep 58, pp 375-377

Results of a systematic investigation of the separation of gases during a discharge in inert gases are discussed.

The following relationships were observed: the degree of separation increases linearly with an increase in tube length; in the pressure range 0.5-1.5 mm Hg, the degree of separation increases considerably with an increase in pressure, but changes only slightly in the range 1.5-4 mm Hg; with an increase in current strength, the degree of separation initially increases linearly with current and then drops off; with an increase in the concentration of an easily ionized admixture, the degree of separation drops and its dependence on pressure and current strength is less pronounced; with an increase in the concentration of a less easily ionized gas, the degree of separation is small. The dependence of separation on the ionization potential of the components of the mixture was not clearly discerned.

It is claimed that the results can be explained qualitatively by the hypothesis that the fundamental process causing gas separation is the migration of positive ions toward the cathode.

III. Polish Work on Atomic-Molecular Physics

Polish Atomic-Molecular Physics Since 1946, "by A. Jablonski, Copernicus University in Torun; Warsaw, Nauka Polska, Year 6, No 2 (22), Apr-Jun 58

This article briefly describes people prominent in Poland in atomic optics are their work, as follows.

J. Rzewuski: Multipole emissions in Lyman series.

J. Dabrowski: Interference of forced dipole emission and spontaneous quadrupole emission.

M. Suffczynski: Ground state of meson.

A. Jablonski: The pressure broadening of spectral lines and magnetic torsion of the polarization plane of the broadened resonance line.

Experimental work in atomic optics:

F. Les and H. Niewodniczanski: Effect of nuclear spin on the possibility of forbidden transitions.

M. D. Kunisz: Intensity ratio in doublets

L. Liszka: Variation of intensity of night sky line 5577 Å

Theoretical work in the domain of molecular optics:

W. Hanus: Torsion oscillator

W. Kolos: Structure of particles.

A. Jablonski: Principle of Condon-Franck; proof that it follows from the general principle of quantum mechanics as a "sudden approximation." Various other work related to photoluminescence of solutions, as attenuation of photoluminescence, depolarization of photoluminescence by migration of excitation energy, the effect of torsion oscillations on the polarization of photoluminescence, extinction laws and work function of luminescence.

Z. Malkowski and others: Studies of spectra of photoluminescence of solutions at the Institute of Experimental Physics of Warsaw University

K. Rosinski: Relation of internal quenching of fluorescence to the temperature of the fluorescent solution, leading to the determination of the activation energy of internal quenching.

Danuta Frackowiak and R. Drabent: Study of organic phosphors and very viscous solutions at monochromatic excitation in the anti-Stokes range showed that a sudden drop of work function does not follow a general law, but depends on individual properties of the luminophors.

A. Baczynski and R. Bauer: The ratio of phosphorescence work function to that of fluorescence depends on the wavelength of the exciting light.

M. Frackowiak: Studied for the first time the extinction of separate components of phosphorescent light excited by polarized light. He obtained the time behavior of phosphorescence intensity. The organophosphors studied exhibited several groups of luminescence centers, each of which has a different glowing time and different polarization.

M. Czajkowski and J. Grzywacz: Study of relation of the polarization degree of fluorescence to the density of dyestuff in plexiglass phosphor gave unexpected results showing that the polarization degree does not decrease with the degree of concentration, but, on the contrary, increases. It may be explained in that the dyestuff particles are excited not directly by absorbing the exciting light, but also by means of the plexiglass which relays the absorbed energy to the luminescent particles.

Zuk, UMCS, K. Guminski and Z. Ruziewicz, UBB: Studies of crystalline phosphors. An accurate method was devised to find the depth of electron traps. Aging of phosphors was investigated.

Wardzynski: Study of absorption spectra of monocrystals in infrared.

A. Tramer, R. Mierzecki, B. Moszynska, K. L. Wierzchowski: Studies of Raman spectra, particularly the effect of particle interaction on Raman spectra intensities of Raman lines, effect of temperature on the shape of Raman lines, Raman spectra of second order, etc.

A. Minc and S. Kurowski: Also involved in the study of Raman spectra at the Institute of Physical Chemistry of the Polish Academy of Sciences

K. Antonowicz, A. Baczynski, W. Berdowski, S. Legowski: Construction of equipment for integrating the Schroedinger equation. The equipment facilitated the determination of proper functions and proper values of the oscillating energy of a Van der Waals particle HgA.

T. Skalinski in A. Kastler Laboratory in Paris (France): Coupling of optic method with magnetic resonance ("optic pumping").

112. Angular Distribution in Cascade Shower Computed

"On the Equilibrium Function of the Angular Distribution of Particles in a Cascade Shower," by I. P. Ivanenko, Moscow State University imeni M. V. Lomonosov; Moscow, Doklady Akademii Nauk SSSR, Vol 122, No 3, 21 Sep 58, pp 367-370

The multiple-scattering approximation is used to obtain formulas for the angular distribution of particles in the maximum of a cascade shower from a primary particle of infinite and finite energy. Ionization losses were considered in the approximation of small and large angles.

113. Academician Artsimovich Explains Award-Winning Work of Soviet Physicists

"International Recognition of Outstanding Discoveries of Soviet Physicists," by Academician L. Artsimovich; Moscow, Izvestiya, 31 Oct 58, p 4

It was with great satisfaction that scientists of our country received the news of the awarding of the Nobel Prize to Soviet Physicists P. A. Cherenkov, I. Ye. Tamm, and I. M. Frank for the discovery, investigation, and explanation of a very interesting and important optical phenomenon which occurs in the passage of charged particles through matter. This phenomenon is named the Cherenkov effect and concerns the fact that charged particles passing through matter with velocities exceeding the velocity of the propagation of light in that substance emit light waves along their path.

The effect was first observed by P. A. Cherenkov in 1934, when, at the suggestion of Academician S. I. Vavilov, he studied the luminescence of fluids under the action of gamma rays from radioactive substances. When various liquids were subjected to a stream of gamma rays, it was observed that a weak blue light was emitted, the intensity of which was practically independent of the chemical composition of the liquid. This radiation also occurred in opaque solids subjected to gamma rays.

The first experiments to study the properties of this radiation showed that it is not connected with ordinary processes of luminescence, which is caused by the excitation of atoms and molecules. It was also

obvious that the observed radiation was caused not by the gamma rays themselves but by fast electrons produced by these rays in the matter. Further experiments were therefore conducted with beams of fast electrons. In the passage of these electrons through various opaque media, the Cherenkov effect appeared in a much more definite and clear form than when matter was bombarded by gamma rays. The characteristic feature of Cherenkov radiation is its special orientation. Light is emitted only along a direction which is at a definite angle to the trajectory of the fast particles in the material.

The phenomenon observed by Cherenkov remained for several years a mystery and could not be successfully explained on the basis of ordinary notions of the interaction of fast particles with matter. However, in 1937, I. Ye. Tamm and I. M. Frank gave an extremely remarkable, but nevertheless simple, explanation. The Soviet physicists showed that if the velocity of a charged particle exceeds the velocity of the propagation of light in the medium through which this particle is passing, the particle in motion must emit light energy and that this light wave must be propagated in a specified direction which was in complete agreement with the experiment.

According to the theory of Tamm and Frank, an electron or other charged particle moving with "superlight" velocities, exhibits properties somewhat analagous to those exhibited by a missile or jet plane flying in air at supersonic velocities. It is well known that the flight of such a missile is accompanied by a wave the front of which is propagated along a direction which makes a definite angle with the trajectory of the supersonic missile. The light waves emitted by the "superlight" electron are analagous to this shock wave which occurs in air in the supersonic motion of a missile. This may seem strange since it is well known that the velocity of light is the absolute upper limit of the velocity which can be obtained by any material object. However, this limit is the value of the velocity of light in a vacuum. In opaque media (water, glass, plastics, etc.) the velocity of light decreases as the index of refraction of the given medium exceeds 1. Usually this decrease in the velocity of light lies within the limits 1.3-1.8. The particle need only overtake light in a given material in order for the Cherenkov effect to occur under these conditions. This applies to electrons which have been accelerated to 200,000-300,000 volts. Heavy particles -- protons, deuterons, and alpha particles -- msut be raised to higher energies. For protons, for example, this energy is measured in the hundreds of millions of volts.

The phenomenon observed 24 years ago by P. A. Cherenkov and explained by I. Ye. Tamm and I. M. Frank has in recent years been frequently used in many areas of experimental nuclear physics. It is the basis of one

of the most widely used methods of observing and recording very fast particles. If an individual fast particle passes through matter, a light pulse arises, caused by the Cherenkov effect. This pulse can be recorded with an apparatus which is extremely sensitive to very small amounts of light energy. (Such instruments are called photomultipliers.) In certain cases, the Cherenkov effect can be used not only to observe a charged particle, but also to measure its velocity, since the angle between the light radiation and the particle trajectory is a function of velocity. The method of recording charged particles through the Cherenkov effect is widely applied in nuclear physics and is now used in many laboratories of the world where cosmic rays and high-energy particles are studied. These high-energy particles are obtained with gigantic accelerators. One can take as an example the recent (1955) discovery of the antiproton, particles which have a charge opposite to that of their counterpart, the proton. Cherenkov counters have played an important role in following changes in the short-lived particle and in determining its nature.

The awarding of the Nobel Prize to P. A. Cherenkov, I. Ye. Tamm, and I. M. Frank is a proper recognition of their great work in the discovery and explanation of an extremely interesting physical phenomenon. Its importance to modern science has only recently become clear. Soviet physicists congratulate their comrades for having obtained this esteemed sign of international recognition.

Mechanics

114. Role of Invariants in Hydrodynamics Discussed

"Invariants of Homogeneous and Isotropic Turbulence in a Compressible Viscous Fluid," by K. A. Sitnikov; Moscow, Doklady Akademii Nauk SSSR, Vol 122, No 1, 1 Sep 58, pp 29-32

Starting with the equations for the conservation of motion, mass, and energy in hydrodynamics and considering the hydrodynamic flow elements as chance variables satisfying the isotropic and homogeneous conditions, it is shown that there are four different forms obtained by an averaging process which are invariant with respect to time and not equal to zero.

An example is given of a flow with invariants different from zero and the values of the invariants are calculated. A law expressed in terms of the invariants is derived for the damping of homogeneous isotropic turbulence in an ideal, viscous, heat-conducting gas.

115. Bending of Round Rod With Elliptical Hole Studied

"Local Stresses Arising on Bending a Round Prismatic Rod With an Elliptical Noncoaxial Hole," by Yu. A. Amenzade; Moscow, Doklady Akademii Nauk SSSR, Vol 122, No 3, 21 Sep 58, pp 356-359

The bending of a round prismatic rod which has been weakened by an elliptical hole passing lengthwise through the rod is studied. The axis of the hole is at a certain distance from the axis of the rod. Functions satisfying the boundary conditions and describing the bending and stress state in the rod are given.

116. Reflection of Waves Incident on Wedge at Brewster's Angle Studied

"Excitation, Reflection, and Radiation of Surface Waves on a Wedge With Given Edge Impedances," by G. D. Malyuzhinets, Acoustics Institute, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 121, No 3, 21 Jul 58, pp 436-439

It is assumed that a two-dimensional wave field $p(r,\varphi)$, $(p \sim e^{-i\omega t},)$ in a wedge-shaped region $r > 0$, $-\Phi < \varphi < \Phi$, is described by the equation $\Delta p + k^2 p = 0$ and satisfies the following homogeneous third-order boundary conditions at the edges

$$(\partial p/r\ d\varphi) \pm ik \sin\theta_{\pm} p = 0, \quad (\varphi = \pm \Phi)$$

where $\sin\theta_{\pm} = z_0/z_{\pm}$; $z_0 = \rho c$, the wave resistance of the medium; $z_{\pm}$ is the normal impedance of the boundaries $\varphi = \pm \Phi$. The constant quantities $\theta_{\pm}$ are Brewster's angles of incidence for which the reflection coefficient of a plane wave approaching an infinite plane with impedances $z_{\pm}$ reduces to zero. In the case of absorbing boundaries $0 < \mathrm{Re}\,\theta_{\pm} < \pi/2$. The exact solution of the problem of diffraction of a plane wave

$$p_0 = \exp[-ikr\cos(\varphi \mp \varphi_0)]$$

on an absorbing wedge and for the case of oblique incidence on the edge, when $p_0 = \exp\{-ik[z\cos\theta + r\sin\theta\cos(\varphi - \varphi_0)]\}$, was obtained in an earlier work of the author ("Certain Generalizations of the Method of Reflections in the Theory of Diffraction of Sinusoidal Waves," Author's Abstract of Doctoral Dissertation, Physics Institute of the Academy of Sciences, 1950.)

An exact solution to the diffraction problem is derived for the general case and given as

$$p(r,\varphi) = \frac{1}{4\Phi i}\int e^{-ikr\cos\chi}\left(\frac{\psi(\chi+\varphi)}{\psi(\varphi_0)}\cos\frac{\pi\varphi_0}{2\Phi}\left(\sin\frac{\pi(\chi+\varphi)}{2\Phi} - \sin\frac{\pi\varphi_0}{2\Phi}\right)^{-1}d\chi,\right.$$

where $\psi(\chi)$ is an auxiliary function.

The particular case of wave incidence at Brewster's angle is analyzed.

117. Dimensional Analysis Applied in the Solution of Magnetohydrodynamic Equations

"One-Dimensional Automodeling Motion of a Conducting Gas in a Magnetic Field," by V. P. Korobeynikov, Mathematics Institute imeni V. A. Steklov, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 121, No 4, 1 Aug 58, pp 613-615

The one-dimensional nonstationary, adiabatic motion of an ideal, infinitely conducting gas with cylindrical and plane waves is considered. A magnetic field is applied perpendicular to particle motion. The equations of motion and their solutions are given. The theory of dimensional analysis is applied in the solution.

The results are applied to the problem of the motion of a plane or cylindrical piston in the gas and the problem of a powerful electric discharge.

118. Criteria for Resonance and Critical Frequencies in Dynamical Systems Given

"On Dynamical Stability of Elastic Systems," by V. A. Yakubovich, Leningrad State University imeni A. A. Zhdanov; Moscow, Doklady Akademii Nauk SSSR, Vol 121, No 4, 1 Aug 58, pp 602-605

Certain mathematical problems arising in the general theory of the dynamical stability of elastic systems are considered. The particular case discussed is that of an unperturbed system with the form

$$d^2y/dt^2 + P_0y = 0$$

and a perturbed system with the form

$$d^2y/dt^2 + P(\Theta t)y = 0$$

or

$$d^2y/dt^2 + [P_o + \varepsilon Q(\Theta t)]\, y = 0.$$

The notions of resonance and critical frequency are defined for a system of this type and a theorem stating necessary and sufficient conditions that a frequency be resonant or critical is given.

The theorem is applied to problems taken from a book by V. V. Bolotin, "the first systematic treatment of the general theory" (Dinamicheskaya Ustoychivost' Uprugikh Sisterm [Dynamical Stability of Elastic systems], 1956).

119. Shock Waves in Magnetohydrodyamics

"Zemplen's Theorem in Magnetohydrodynamics," by S. V. Iordanskiy; Moscow, Doklady Akademii Nauk SSSR, Vol 121, No 4, 1 Aug 58, pp 610-612

Shock waves in an infinitely conducting medium with negligible dissipation and subjected to a magnetic field are discussed, particularly shock waves in which matter passes through the surface of the shock, causing a change in the thermodynamic quantities.

It was shown in a book by L. D. Landau and Ye. M. Lifshits (Elektrodinamika Sploshnykh Sred [Electrodynamics of Continuous Media], Moscow, 1957) that only compression waves are possible when the magnitude of such shocks, under the same conditions as for ordinary shock waves, is small. The article shows that this statement is true for shocks of any magnitude.

120. Equations for Limiting Automodeling Motion of a Gas and Piston Given

"The Limiting One-Dimensional Automodeling Nonstationary Motion of a Gas (The Cauchy Problem and the Problem of a Piston)," by S. S. Grigoryan, Moscow; Moscow, Prikladnaya Matematika i Mekhanika, Vol 22, No 3, May/Jun 58, pp 301-310

The limiting automodeling motion of an ideal non-heat-conducting gas in cases of the Cauchy problem for the equations of one-dimensional, nonstationary motion with plane waves and the problem of a symmetric piston discharging a gas are discussed. A limiting automodeling problem is defined as one which can be obtained from the corresponding automodeling problem by a transition to the limit.

It is shown that the limiting automodeling problem does not always have a solution and that under certain conditions a solution to the problem is not unique. The limiting automodeling problem of a piston is shown to have always a unique solution.

Only a qualitative analysis of the problem is made, but it is stated that numerical results may be easily obtained from the solution given.

121. Propagation in Nonideal Media Treated as Linear Problem

"On One Method of Integrating Nonstationary Linear Boundary-Value Problems Concerning the Propagation of Disturbances in Nonideal Elastic Media," by Ye. I. Shemyakin, Leningrad; Moscow, Prikladnaya Matematika i Mekhanika, Vol 22, No 3, May/Jun 58, pp 289-300

Problems in mathematical physics, which take into account the nonideal character of the actual media, can be solved without going outside the framework of linear problems, it is claimed. The example given of problems, which fall within the class of linear problems and which can be solved with a high degree of accuracy, is the problem in theoretical seismology concerning the propagation of vibrations from a source such as an explosion.

To solve the nonstationary problem for a viscous-elastic half-space and for a half-space filled by a medium with elastic aftereffects, the method of incomplete separation of variables was used.

The equations of motion of a D-medium, a medium with energy dissipation, are given as

$$(\Lambda + 2M) \text{ grad div } \underline{u} - M \text{ curl curl } \underline{u} = \rho \partial^2 \underline{u}/\partial t^2,$$

where $\underline{u} = \underline{u}(x, y, z, t)$ is the displacement vector, Λ and M are operator substitutes for the elastic constants λ and μ,

$$\Lambda = \lambda + \lambda' K_t, \qquad M = \mu + \mu' K_t,$$

K_t, some linear operator.

The initial conditions are

$$\underline{u}\Big|_{t=0} = 0 \quad \text{and} \quad \partial \underline{u}/\partial t\Big|_{t=0} = 0$$

and the boundary conditions are

$$T_1 = L_1 (\underline{u})\Big|_S, \qquad T_2 = L_2 (\underline{u})\Big|_S, \qquad T_3 = L_3 (\underline{u})\Big|_S,$$

where L_1, L_2, and L_3 are the ordinary linear operators in Hooke's law and the functions T_1, T_2, and T_3 are of the form

$$T_i = f_i(x, y, z)\Big|_S \; a_i(t), \qquad (i = 1, 2, 3).$$

The functions $a_i(t)$ represent the dependence of the interactions T_i on time.

The solution of the problem is given as

$$\underline{u}(x, y, z, t) = \int_0^\infty \underline{u}_0(x, y, z, \tau)\; R(t, \tau)\; d\tau,$$

where $\underline{u}_0(x, y, z, \tau)$ is the solution of the motion equations for $K_t = 0$ and t replaced by τ; $R(t, \tau)$ is the solution of the problem

$$(1+\omega K_t)\frac{\partial^2 R(t,\tau)}{\partial \tau^2} = \frac{\partial^2 R(t,\tau)}{\partial \tau^2}$$

$$R\Big|_{t=0} = \frac{\partial R}{\partial t}\Big|_{t=0} = 0, \qquad (1+\omega K_t)\; R(t,\tau)\Big|_{\tau=0} = a(t).$$

By using the basic formula, further generalizations were obtained for the above class of problems for D-media and for other nonstationary boundary-value problems such as laminated isotropic D-media with plane-parallel separation boundaries and for regions filled by a

D-medium and containing spherical or cylindrical boundaries. This generalization required only that certain restrictions be placed on the operator K_t and that the results of previous work be used to construct $\underline{u}_0(x, y, z, \tau)$.

It is also noted that it is possible to construct the solutions of these additional problems by the method of incomplete separation of variables, but that a direct approach is difficult. For simple problems such as a half-space filled by a D-medium, it is suggested that a generalization of the Efros transformation be applied and that the perturbation fields be investigated by asymptotic methods.

IX. MISCELLANEOUS

122. Division of Physics and Mathematics of Academy of Sciences Tadzhik SSR Expands

"We Are Expanding Research on Physics and Mathematics," by A. Babayev, scientific associate, Division of Physics and Mathematics, Academy of Sciences Tadzhik SSR; Stalinabad, Kommunist Tadshikistana, 21 Sep 58, p 2

The Division of Physics and Mathematics (Otdel Fiziki i Matematiki) of the Academy of Sciences Tadzhik SSR, formed in the fall of 1957, consists of the Sector of Physics and the Sector of Mathematics and four laboratories which are being formed. These laboratories will be the Laboratory of Physical Electronics (Laboratoriya po Fizicheskoy Elektronike), the Laboratory of the Physics of Solids (Laboratoriya Fiziki Tverdogo Tela), the Laboratory of Spectral Analysis (Laboratoriya Spektral'nogo Analiza), the Laboratory of Applied Nuclear Physics (Laboratoriya Prikladnoy Yadernoy Fiziki). All four laboratories are to be equipped with the latest precision instruments. The work of these laboratories will be closely tied with the work of various plants, factories, and other industrial establishments, as well as with other scientific research institutions of neighboring republics.

Through the initiative of S. U. Umarov, president of the Academy of Sciences Tadzhik SSR, the new division has established close contact with the Physicomathematical Institute, the Institute of Nuclear Physics, and the Institute of Mathematics and Mechanics of the Academy of Sciences Uzbek SSR. The division will also work closely with related institutes of the Academy of Sciences USSR.

123. Over 170 Problem Laboratories Operate in Soviet Vuzes

"170 Problem Laboratories," by P. Polukhin, deputy chairman, Scientific-Technical Council of the Ministry of Higher Education USSR; Moscow, Promyshlenno-Ekonomicheskaya Gazeta, 2 Nov 58, p 1

At present there are over 170 problem laboratories in operation within vuzes (higher educational institutions) of the USSR. These laboratories are conducting high-level research on such problems as nuclear physics, radiochemistry, search for new semiconductor materials, utilization of computer technology for technical and economic calculations, automation

processes, new methods for transmitting electrical energy, and the synthesis of new materials. These laboratories are established at present in such institutes as the Moscow Higher Technical School imeni Bauman, the Leningrad Electrical Engineering Institute imeni V. I. Ul'yanov (Lenin), the Tallin Polytechnic Institute, the Moscow Institute of Nonferrous Metals and Gold, and Leningrad Institute of Precision Mechanics and Optics, and the Ural Polytechnic Institute.

124. V. A. Ambartsumyan, President of Academy of Sciences Armenian SSR

"Outstanding Soviet Scholar," by A. Shaginyan, Academician, Academy of Sciences Armenian SSR, and S. Ambartsumyan, Corresponding Member, Academy of Sciences Armenian SSR; Yerevan, Kommunist, 19 Sep 58, p 2

Viktor Amazaspovich Ambartsumyan, president of the Academy of Sciences Armenian SSR and director of the Byurakan Astrophysics Observatory, was recently awarded the Order of Lenin by a ukase of the Presidium of the Supreme Soviet USSR for his outstanding services in the field of the development of astrophysics and in connection with his 50th birthday.

The scientific activities of V. A. Ambartsumyan began at the Leningrad State University from which he graduated in 1928. In 1931 he completed the "aspirantura," where he worked under the directorship of the outstanding astrophysicist, Acadamician A. Velopol'skiy. After completing the "aspirantura" Ambartsumyan began to work in the capacity of docent at the Leningrad State University, and in 1934, after being promoted to professor, became head of the Chair of Astrophysics, which he founded. From 1938 on, Ambartsumyan was also the director of the Astronomical Observatory of the Leningrad State University.

In 1939, he was elected Corresponding Member of the Academy of Sciences USSR and subsequently appointed as prorector for scientific affairs of the Leningrad State University.

During World War II, Ambartsumyan directed the branch of scientific research laboratories of the Leningrad State University, which had been evacuated to the city of Yelabuga.

In 1943, after being elected Active Member and vice-president of the newly organized Academy of Sciences Armenian SSR, V. A. Ambartsumyan arrived in Armenia, where since 1947 he has continuously headed the Academy of Sciences Armenian SSR; at the same time he has been the director of the Byurakan Astrophysics Observatory.

Ambartsumyan has been elected a Correponding Member of many foreign academies of sciences and scientific societies, i.e., Austria, England, Belgium, the US, and others. He has been awarded two Orders of Lenin, two Orders of the Labor Red Banner, and medals. He has also received two Stalin Prizes.

Ambartsumyan's fame lies in his development of the theory of stellar associations which has led to the study of the physical nature of stellar bodies included in the formation of stellar associations. He is currently investigating the new field in astrophysics, the problem of radio galaxies.

125. New Polytechnical University Founded in China

"Chinese University of Science and Technology Opens" unsigned article; Peiping, K'o-hsueh T'ung-pao (Scientia), No 19, 1958 pp 604-605

This article reports the highlights of the inauguration of a new polytechnical university in China, the Chinese University of Science and Technology (中国科学技术大学), on 20 September 1958. That date, according to the article, marked the initiation of classes in the university's 13 departments, including the Department of Nuclear Physics and Nuclear Engineering, Department of Technical Physics, Department of Chemical Physics, Department of Physical Heat Engineering, Department of Radioelectronics, Department of Automation, Department of Mechanics, Department of Radiochemistry and Radiation Chemistry, Department of Geochemistry and Rare Elements, Department of High Molecular Chemistry and Physics, Department of Applied Mathematics and Computation Techniques, and Department of Biophysics and Applied Geophysics. (These total only 12.)

During the opening exercises, university president Kuo Mo-jo talked about making the school a model new-type Communist university by following party leadership, using science and technology in the interest of national construction, and implementing the new Communist system of education, which involves combining work with study and teaching activities with research and productive labor. He said that the school year at the Chinese University of Science and Technology will allow 8 months of study, 3 months of physical labor, and one month in holidays. Moreover, a small-scale factory for each department and a larger, comprehensive one for the whole school are to be established.

Drawing a parallel between the new university and the Resist-Japan University which existed during the "War Against Japanese Aggression," Kuo called on his students to inherit the "excellent spiritual tradition" of the former university and train themselves quickly in socialist construction so that China may rapidly become a Communist utopia..

[SIR Note: The article does not give the exact location of the new university, but it is probably Peiping, where Kuo Mo-jo also holds office as president of the Academia Sinica.]

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